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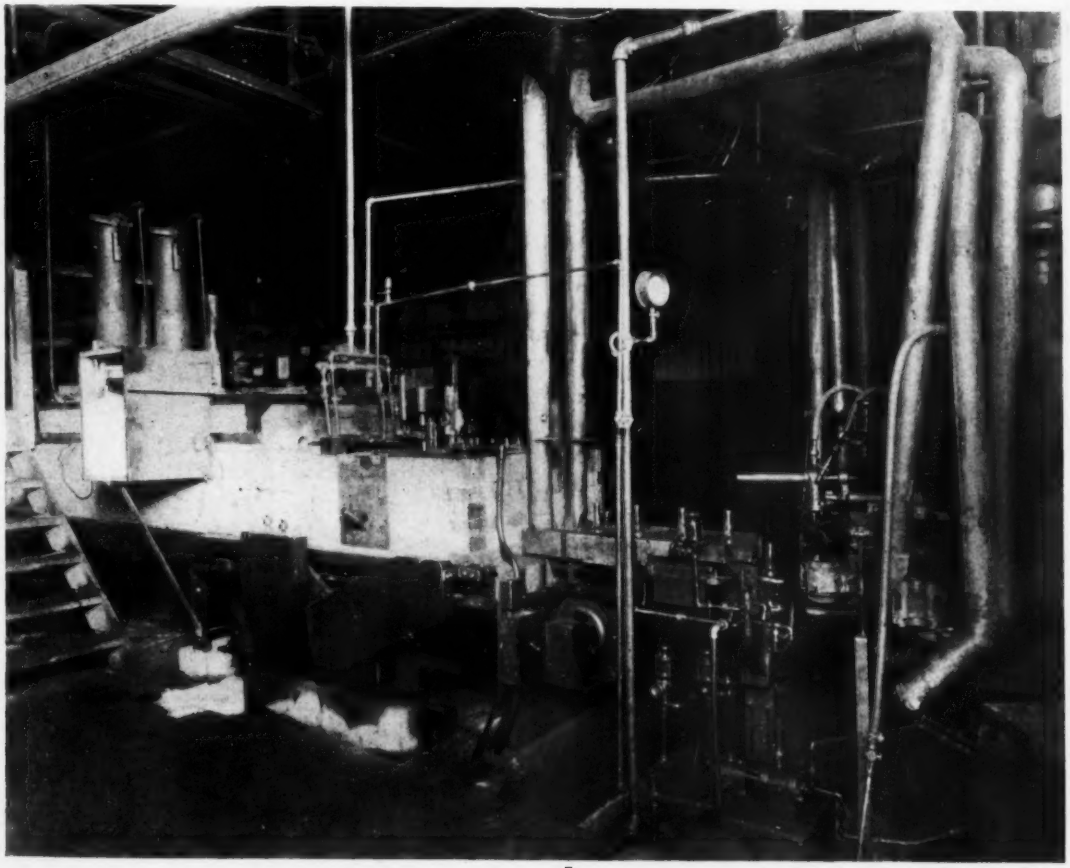
The Full Automatic Fuelless Annealing Device

A New Lehr Which Has Been in Successful Production for Seven Months

The annealing of glass vessels, until recently, was by most glass manufacturers considered of secondary importance, most of their effort being confined to the developing of glass feeders and glass forming machines, their primary problem.

One of the first annealing devices used was the oven, which was heated, filled with ware, closed and allowed to cool gradually. The oven, often of crude design, was used during the off-hand, wood mold and part of the iron mold era.

With the development of the hand press and chilled iron molds, the increase of production brought into practice the pan type lehr or a long oven having a fire box at the front, pans hooked to each other and pulled by hand at the rear.



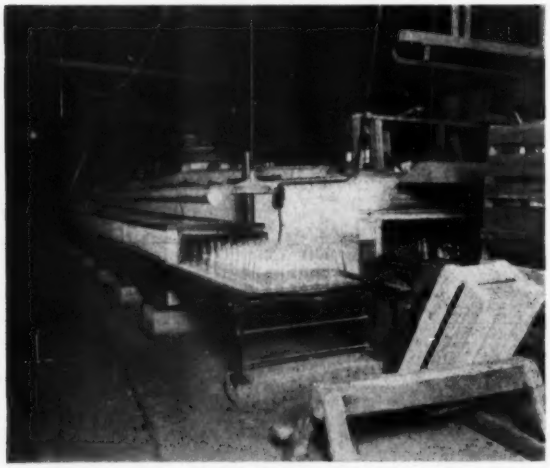
THE SHACKELFORD-MAYO ANNEALING DEVICE IN OPERATION

An invention that finally eliminates all manual labor from the glass-making process between the automatic blowing machine and the packing room. It requires no fuel during annealing operations, substitutes a novel conveyor for the customary continuously moving belt, and embodies an automatic ware stacker and other advanced ideas.

Following the use of semi-automatic machines and a further increase of production, the continuous pan type conveyer lehr was used, this lehr also having a combustion chamber at the front. The conveying part consists of endless sprocket chains with flat cross pieces fastened to the chains and revolving around large sprocket wheels located at each end of the lehr, the pulling being accomplished from the rear by the means of a motor and reduction gears.

With the advent of the vacuum and gob feeder method, the machines became entirely automatic and the ensuing increase of production necessitated the use of wider and longer lehrs of the continuous pan type.

The development of automatic ware handling devices to



DISCHARGING END

convey the articles from the machine to the lehr occurred at this time, such devices being composed of endless asbestos belts, metal chains, dead plates, lifting and transferring jaws, star wheels, pusher bars, reciprocating troughs, tongs, deflectors, disks, and so forth.

And now a further development embodying revolutionary ideas for the automatic stacking and annealing of glassware and the elimination of fuel from the operation has been successfully accomplished. A new, completely automatic, continuous annealing device, which eliminates all of the above-mentioned parts for stacking ware and which consumes no fuel while in operation, has been in commercial operation for the past seven months at the bottle plant of the Peerless Glass Company in Long Island City, New York, with notable success, production reports showing such substantial reductions in cost and decided improvement in the quality of the ware that the company has placed an order to equip its entire plant, with nine more lehrs of this type.

The device automatically takes the ware directly from the forming machine while it is in a hot or semi-plastic state and places it in the annealing chamber before strains have developed, obviating the necessity of reheating. The heat in the ware as it comes out of the mold is conserved and the ware passes through a generous soaking or equalizing period and is subjected to a gradual, regulated cooling process.

Though no fuel is used in the annealing operation, the annealing chamber of course must be ready at the proper temperature for receiving the hot ware from the machine molds at the moment that blowing is resumed after a cessation of operations. For this purpose, two small burners using city gas fed by ¼ inch pipes at ½ ounce pressure are provided and the preliminary heating accomplished by means of a muffle chamber built over the soaking section just back of the stacking device. No flame enters the annealing chamber.

The burners are used only for maintaining a temperature of 800 deg. F. in the idle annealing chamber on Sundays. They are in operation only during the week-end shutdown and for about an hour after the machine is started on Monday morning, by which time the heat in the slowly moving ware itself is sufficient for annealing requirements. Unless the blowing machine breaks down or stops for more than thirty minutes, the fire is not turned on again until the following Sunday.

The common practice of stacking ware in the lehr by hand permits strains to develop and necessitates reheating the ware to remove them. No satisfactory mechanical device had heretofore been available which would take all kinds of ware at the mold and stack or distribute it without sticking or distorting the shape while in a semi-plastic state. With the successful development, however, of the entirely new method here described for uniformly loading and stacking any kind of ware that will stand on its own bottom, by a completely automatic device, it has become practicable to eliminate the use of fuel in the annealing operation.

The New Device

The external features of the new device are seen in the illustrations. The connection between the blowing machine and the annealing chamber, which constitutes the last link that has been needed to make the chain of processes involved in the making of glassware entirely automatic, consists of an air-operated vertical plunger having a circular flat plate at the top, adjustable for height according to the size of the article being blown, and a three foot long carrier or conveyor leading to the stacking chamber.

The plunger with its accessory equipment is located close to the mold and when the mold opens, the bottle or other ware, as the case may be, is instantly transferred by the machine to the plate at the top of the plunger, which then rises to the level of the carrier, from which position the article is pushed by an automatic wiper on to the carrier leading to the annealing chamber. Each piece of ware goes in at the same temperature and time interval.

The carrier is composed of a series of small steel rollers placed close together horizontally across the passage. At the ends of the rollers, bearings are provided in which they continually rotate. Sprocket wheels are mounted on the ends of the rollers and a chain drive actuated by a small G. E. motor furnishes the power for keeping them turning at the desired speeds throughout the entire length of the annealing machine.

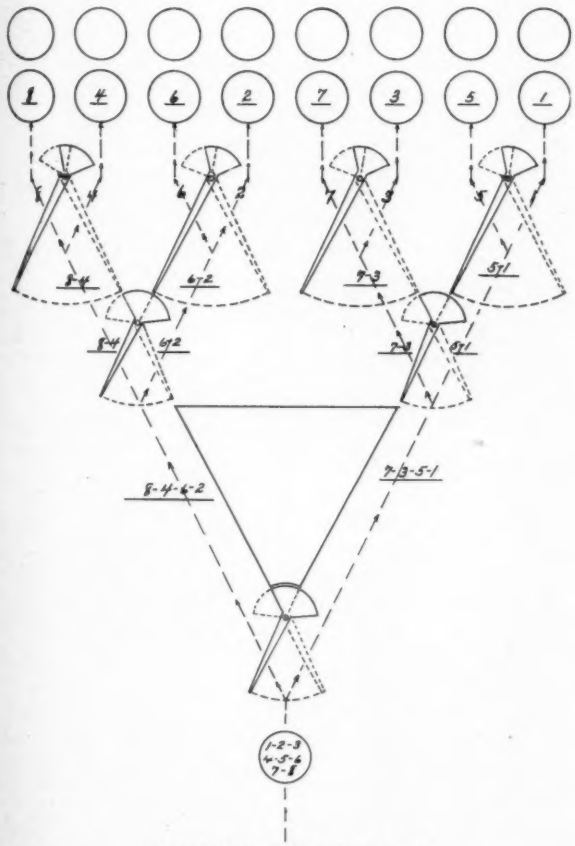
The carrier at the entrance end, connecting the machine with the annealing chamber, is quite narrow as the bottles are moved over it in a single row, but inside the chamber the carrier occupies the full width of 33 inches. The clear height inside the chamber is 13 inches. The rollers support the ware and their turning motions convey it into the stack-

ing or usher section which extends back from the front of the chamber a distance of approximately four feet. Here the articles are automatically spaced and placed in straight or staggered rows, as desired. Next there is a nine foot soaking section and following that a 76 foot annealing space and a 6 foot uncovered packing section.

The rollers comprising the front part of the carrier from its outer end for a distance of several feet to a point back of the ushers are rotated at a higher speed than the main section of the carrier, in order to accelerate the loading operations.

A feature of this roller type of carrier is the elimination of the necessity for reheating an endless metal conveyor or pans as they re-enter the lehr. Another advantage is the elimination of the carry-in boy. Also the driving mechanism is at the front or in the factory with the rest of the machines where it can be controlled by the machine operator instead of the selector or packer.

The side walls of the annealing chamber are constructed



AUTOMATIC STACKING DEVICE

of a single course of Nonpareil insulating brick supported on a steel frame resting on concrete piers. Underneath the rollers the chamber is insulated. The top is covered with corrugated iron on which sheets of insulating material are laid, the thickness varying according to the requirements at each point. Changes in the interior temperature may be effected by varying the thickness of the insulation.

Temperature readings are taken by means of a Wilson-Maeulen high resistance, mono-pivot, pyrometer indicator, having a scale range up to 1,200 deg. F., and equipped with an automatic electrical cold junction compensator and a ten point and off, double pole, dust and fumeproof, rotary switch. The instrument, compensator and switch are mounted on a large ebony asbestos wood panel board.

There are ten base metal Pyod thermocouples installed horizontally through the side of the stacking, soaking and annealing sections and so arranged that their tips line up along the center of the chambers, just above the ware as it passes through. In these couples one of the elements forms the protection tube, making them especially suitable for this application because they are responsive to the slightest change in temperature. Compensating leads run from each couple to the instrument switchboard, where the cold junction compensator effectively corrects for the variation in temperature surrounding that switchboard.

The Stacking Device

The stacker is actuated automatically by the ware. Immediately on entering the chamber the ware comes in contact with an usher, a wedge-shaped finger of metal suspended from the roof of the chamber, and trips it. The usher gently but firmly turns the first bottle to the right and in doing so becomes set in position to turn the second one to the left, beginning thus the formation of two rows. Each of the two bottles then meets, further back, another usher and is compelled to detour again from its straightaway course and begin the formation of the third and fourth rows. By means of this ingenious control method a whole series of ushers is so regulated that the bottles are made to take their places automatically in two, four, eight, twelve or sixteen rows, or in staggered rows, as previously mentioned.

Handled in this manner on the revolving rollers, the ware suffers no pushing, pulling, checking or deformation, the use of a dead plate is avoided, and one piece of ware is not allowed to touch another.

The Peerless Glass installation serves a Lynch blowing machine having a production capacity of 170 gross of bottles every 24 hours. During its period of operation, the complete elimination of breakage has been recorded.

The stacker in use at this plant will accommodate any size of ware from 1¼ inches to 4 inches in diameter, irrespective of whether the shape is round, square, oval, hexagonal, or octagonal. Any size within its limits can be stacked without making changes in the machinery or adjustments of any kind. It is stated, moreover, that there is no limit to the size of the ware that can be handled by a stacker of this type: they can be built to take care of anything from a carboy to a vaseline jar.

The equipment described above is the invention of Orie Shackelford, and was developed by John Mayo, both of Fairmont, West Virginia. They are practical men who have been engaged in glass manufacturing for years. They claim the following as desirable features in a device of this kind:

No fuel when in operation, no carry-in boy, no checking, no jamming, no rocky bottoms, consistent performance, minimum and continuously changing bottom contact, front device, accessibility to all parts from the outside, no breakage, rugged design, simplicity of operation and a non-heat-disseminating conveyor. Patent applications have been filed.

Development of the Unit Lehr

By W. A. Morton*

THE CONTINUOUS OPEN FIRED LEHR, 1910

Glass annealing lehrs of the motor driven endless belt type were first designed to meet the requirements of machine production by eliminating the intermittent hand pulled conveyor pan, over twenty years ago. Progressive manufacturers built mechanical ware feeding devices to load these lehrs, but the distribution of heat to the various heavy moving parts was wholly inadequate at the time and the lehr feeding problem remained unsolved.

THE RAW PRODUCER GAS FIRED MUFFLE LEHR, 1916

About the year 1916 a new muffle lehr idea was offered to the American manufacturers as a solution to their ware washing problems. The original units used standard malleable chain, connected with soft steel pins and ordinary strip steel pressed into channels. Considerable mechanical difficulty was experienced with the chains breaking under the prevailing heat and load conditions. Annealing in these lehrs was fairly good and bloom on ware usually occurred after the units were heated and cooled several times.

THE AMCO "C" TYPE LEHR, 1922

The conditions under which a muffled lehr with a heavy endless type belt must operate, were well developed during the preceding years and a new instructive phase with a reliable background of experience as its inception was entered.

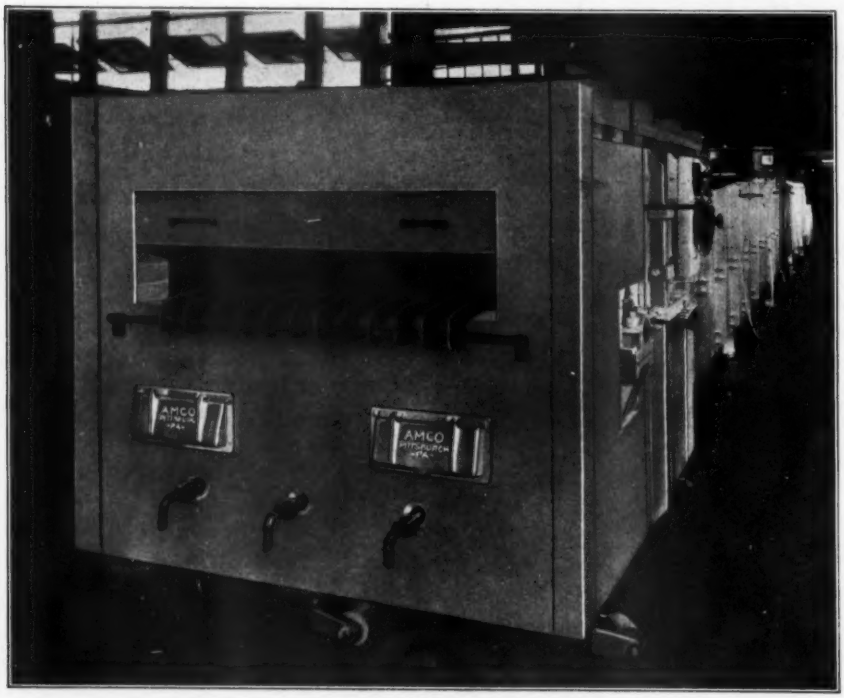


FIG. 1. FRONT OR CHARGING END OF HAND FED LEHR

Full malleable chains provided the necessary tensile strength to draw a heavily loaded lehr conveyor at glass annealing temperatures; high carbon steel pans overcome sagging and warping. Such equipment was developed by continuous expensive experimenting with various metals under actual operating conditions.

By this time it was known that most of the fuel supplied to lehrs of this type was required to satisfy the thermal capacity of the heavy metal conveyor—about 10 tons of steel in the average lehr. This meant heating 20 tons of steel daily to about 1100 deg. F., in an average operation and 40 tons to about 1400 deg. in a relatively fast one. This thermal demand of the *faster* moving lehr conveyor contributed to most of the weaknesses of the heavy type lehrs. More heat had to be transmitted per square foot of tile—therefore the temperatures were increased, and generally beyond the safe limit of the metals available for this work.

This experience led to a restriction of conveyor speed to usually 3 hours or more. In many cases this time was double that actually required for annealing the ware and unnecessary lehr space was employed and available economies remained unrealized.

THE "C" LEHR ADAPTIBILITY TO WARE FEEDING

The "C" lehr had many important features which led to its wide adoption for successful annealing of glass fed mechanically from a forming machine and for such as Pyrex, heavy lead blanks and gallon packers to which it was well suited. Means were provided in these lehrs for controlling the heat flow toward the front of the lehr for heating a ware feeding conveyor and, by a series of dampers, the temperature gradient could be definitely regulated for the annealing times to which the lehr was restricted by its heavy metal moving elements.

THE AMCO UNIT LEHR

Early in 1921 Amco engineers became interested in a unit lehr to receive the ware from a single machine to eliminate the production losses experienced when a large wide lehr was temporarily out of service for repairs.

Such a lehr was designed at that time in a portable unit to enable the lehr to be drawn away from the machine to facilitate the usual machine repairs at a point remote from the furnace. This early lehr received little consideration from the manufacturer but its possibilities were readily grasped and much development work was done by various engineers during the next three or four years, and the method is now generally accepted as the most economical means devised for annealing.

*Amsler-Morton Company, Pittsburgh, Pa.

UNIT LEHR PERFORMANCE, 1927

A well designed lehr of this type will use about 10 per cent to 15 per cent of the fuel required by an ordinary lehr annealing the same quantity of glass. The annealing will be better and uniformly the same across the conveyor. A 36 in. lehr will replace the average 8 ft. 10 in. lehr and do the same work better. Tests indicate that about 6 tons of ware per lineal foot width of conveyor may be thoroughly annealed with but a fraction of the fuel and time formerly required. Either oil or gas fuel can be applied to the lehr.

Many manufactures will ponder over the advisability of immediately discarding obsolete annealing lehrs to instal the unit lehr. The economy realized will vary with the nature of the work to be done and will vary from $10 to $40 per day per lehr. The cost of glass production by the large manufacturer will regulate the selling price and the general adoption of such equipment by leading producers will have the usual effect on the smaller manufacturer. It is quite obvious that the discerning individual will immediately sense a recurring situation and prepare to take advantage of an investment offering tremendous economies, bow to the inevitable and get in step with the "history makers."

THE "WHY" OF THE AMCO UNIT LEHR

The Amco unit lehr is a portable rigid steel structure, encasing a lining of the highest quality of insulating materials to reduce the fuel required to a minimum. The firebox is of carborundum and waste heat to control the gradient is passed through a metallic duct extending the entire length of lehr.

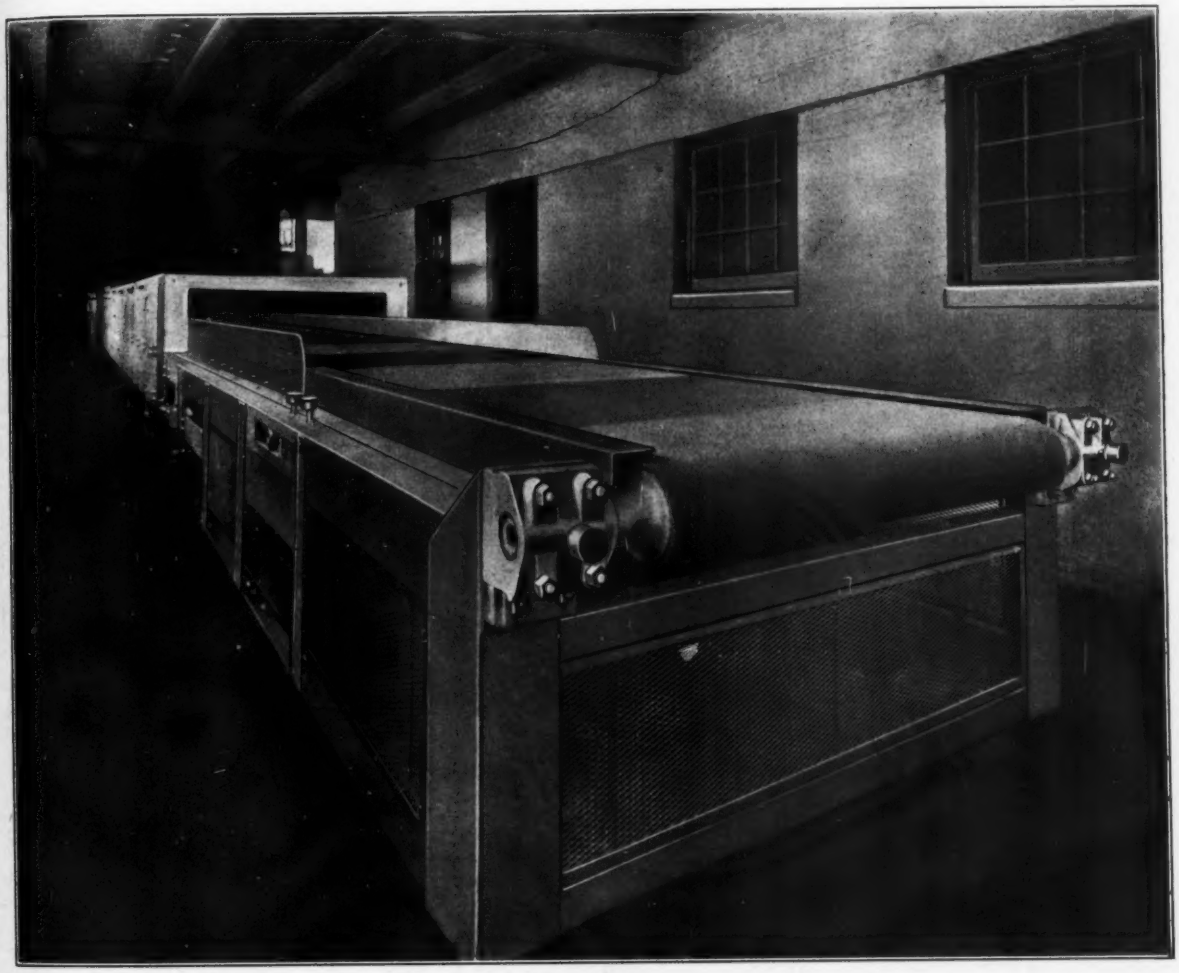


FIG. 2. DISCHARGE END OF LEHR

The great reduction in annealing time is due to the extension of the heating element. This enables ware to travel two to three times the ordinary rate—and receive the required time and temperature conditions essential to proper annealing. The ware is cooled at the rear end by a simple ingenious application of the direct principles of the old style "squirrel tail" flue over the lehr. This cooling enables the ware to be delivered to the packer slightly above room temperature, regardless of the rate of production.

A study of Fig. 4 reveals that by extending the firebox to meet a given annealing condition the "distance" through which a glass article must pass will double for a given time, which will of course remain constant. Assuming 700 deg. as the lower critical annealing temperature it will be observed that in one hour the article would leave the critical zone 20 ft. back in the old lehr, shown in curve "A"; if this time per-

ANNEALING SCHEDULE:—
HOLD THE GLASS AT THE PROPER ANNEALING TEMPERATURE FOR THE INDICATED TIME AND COOL AT THE INDICATED RATE.

KIND OF GLASS.	THICKNESS — ANNEALING TEMPERATURE DEGREES CENTIGRADE				
	1 Cm.	2 Cm.	5 Cm.	10 Cm.	20 Cm.
BOROSILICATE CROWN	561	541	515	495	475
ORDINARY CROWN	535	514	481	466	445
LIGHT BARIUM CROWN	571	552	527	508	489
DENSE BARIUM CROWN	608	592	572	556	540
BARIUM FLINT	516	494	466	454	423
LIGHT FLINT	427	408	384	366	348
MEDIUM FLINT	434	418	397	382	366
DENSE FLINT	424	407	386	370	353
EXTRA DENSE FLINT	400	382	357	339	321

ANNEALING TIMES—COOLING RATES—DEGREES CENTIGRADE PER HOUR.

	50 MIN.	3½ HRS.	21 HRS.	86 HRS	14 DAYS
INITIAL RATE	96	24	3.8	1.0	0.2
RATE AFTER 10°	116	29	4.6	1.2	.3
RATE AFTER 20°	144	36	5.8	1.4	.4
RATE AFTER 30°	184	46	7.4	1.8	.6
RATE AFTER 40°	240	60	9.6	2.4	.7
RATE AFTER 50°	319	80	13.0	3.2	.8
RATE AFTER 60°	432	108	17.0	4.3	1.1
RATE AFTER 70°	591	148	24.0	5.9	1.5
RATE AFTER 80°	816	204	33.0	8.2	2.0
RATE AFTER 90°	1134	283	55.0	11.0	2.8
RATE AFTER 100°	1584	396	63.0	16.0	4.0
MAXIMUM COOLING RATE	2400	600	96.0	24.0	6.0
MAXIMUM HEATING RATE	7200	1800	288.0	72.0	*18.0

FIG. 3. TABLE OF ANNEALING TIMES

mitted satisfactory annealing, then by elevating the temperature curve to correspond with curve "B", double the quantity of ware would be received in 40 ft. of lehr without changing the time the ware was in the critical zone temperature 1,050—700 deg. F. This is the principle employed to speed up the conveyor and also meet the annealing time requirements.

The conveyor is a light woven wire belt weighing about 3 pounds per square foot and operates entirely within the lehr, thereby saving additional fuel and making the lehr one of the most economical ever built. This belt has a low thermal capacity and presents a limited surface in contact with the glass, eliminating strain and bottom checking.

A unique feature of design is the complete absence of expansion joints and the elimination of such weak links in a gas or oil fired furnace.

The waste heat leaves the lehr at about 300 deg. F. where it is diluted with air and passed through an exhauster instead of a chimney.

The drive mechanism is an assembly of standard units, with a Reeves variable speed transmission to give a ratio of 4 in. to 24 in. per minute on the conveyor belt. The power consumption is about ⅙ h.p. for a fully loaded 4 ft. x 75 ft. lehr conveyor.

The drive and exhauster are located under the ware sorting table formed by the exposed rear portion of lehr conveyor.

The lehr is readily equipped with pyrometer, draft gage and automatic temperature control devices; coupled with the motor driven exhauster the above devices insure complete freedom from the annoying temperature fluctuations of the ordinary lehr.

These units are being installed at the present time in sizes ranging from 3 ft. to 8 ft. wide and of varying length to meet any particular problem. They are both hand and automatically charged.

There are no moving parts of the lehrs exposed except the discharge portion of the lehr conveyor and when fully completed the unit presents a handsome, clean, spick, mechanical appearance.

Experiments with Lehrs

Describing experiments with lehrs at the plant of the United Glass Bottle Manufacturers, Ltd., E. A. Coad-

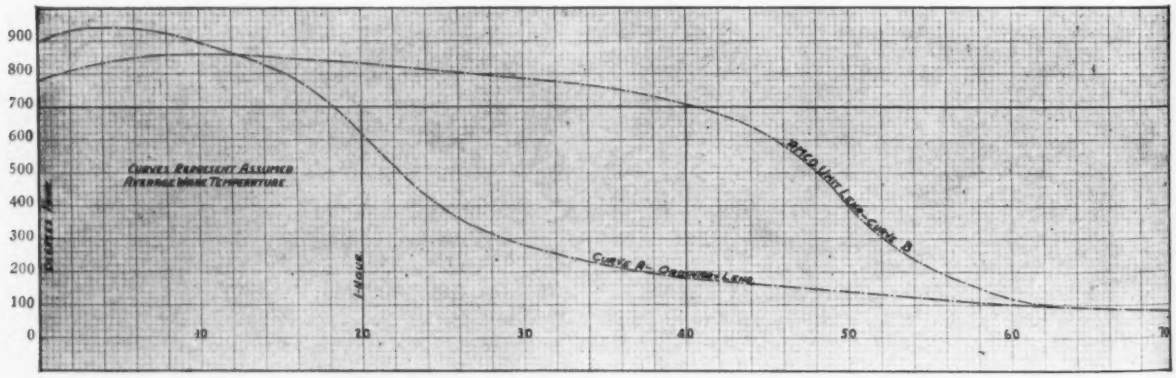


FIG. 4. CURVE SHOWING HOW THE PRODUCTION OF A SMALL LEHR IS MADE TO EXCEED THAT OF A LARGE ONE MAINTAINING THE NECESSARY TIME AND TEMPERATURE FUNCTIONS THROUGH CRITICAL GLASS ANNEALING RANGE

Pryor said it was interesting to find that an alteration in the weight of the bottle being annealed did not greatly affect the heat balance; because, although the bottles took less heat into the lehr, the annealing time was very much less, and, therefore, they had only to balance the heat in the bottle with that lost from a smaller portion of the lehr. An experimental lehr with heat supplied through the slats of the conveyor, proved very successful.—*Soc. Gl. Tech.*

Manufacture of Light-Diffusing Glasses

By J. B. Krak, Technical Editor

A realization of the harmful effect of eye strain on the nervous system, and through this on general health conditions has become so universal that the trend of the times is now definitely set towards elimination of direct light and its resulting glare, by the use of light-diffusing glasses for illuminating glass ware. Not long ago, electric light bulbs were made of transparent glass exclusively, and were surrounded by bowls of opal glass, or by opal reflectors, serving as a protection against direct light rays. The next step was the frosting of electric light bulbs on the outside, either by means of the sand blast, or with alkali fluorides. This proved to be unsatisfactory since the rough glass surface soon became covered with dust and soot, that was hard to remove, and seriously interfered with the effectiveness of the light. Then came the invention of the inside frosting process, now widely adapted, and which in time may render the transparent electric light bulb entirely obsolete.

Besides light diffusion caused by frosting or sand blasting of the glass surface, there is a large class of glasses which diffuse light on account of their inherent properties, the non-transparent, opaque, alabaster or opal glasses. These terms are all poorly defined. They include glasses that are faintly opalescent, those that are translucent by transmitted light and opaque by reflected light, and glasses which appear opaque by both reflected and transmitted light.

The Illuminating Engineering Laboratory of the General Electric Company has made an effort to classify opal glasses with reference to their density and light transmission, as follows:

Designation:	Per Cent Transmission	Per Cent Loss
Clear	90 or more	10 or less
Very light density	85 to 90	15 to 10
Light density	75 to 85	25 to 15
Medium density	60 to 75	40 to 25
Heavy density	50 to 60	50 to 40
Very dense	50 or less	50 or more

An ideal light-diffusing glass should diffuse a bundle of parallel light rays without any losses due to reflection or absorption, and be such that it appears to be giving off light itself. While this is, of course, an impossible condition, yet developments are tending more and more towards this goal. A distinction may be made between three kinds of opacity, one which causes reflection of the light rays, another which causes refraction of the light rays and a third which causes bending of the light rays. In the majority of opal glasses all three effects are taking place at the same time. But in different kinds of glass, one or the other effect predominates, and determines the character of the glass.

Different varieties of opal glass act in a different manner toward light rays of varying wave lengths. The best known example of this is the phenomenon known as "fire" in opal glass, in which the electric light filament appears more or less sharply defined, in a deep red color. This effect seriouly impairs the beauty of illuminating glass ware, yet it is at times difficult to avoid. The effect of the minute particles causing opacity (whatever they may be) depends not only on their number, but also on their size, and on their way of being grouped together. These elements depend largely on the temperature conditions, and on the length of time during which the glass has been exposed to heating. For this reason it is little wonder that so much "bad luck" is encountered in the manufacture of opal glass, in factories where scant attention is given to maintaining proper temperature conditions, and where adequate control of furnace operations is neglected. Whoever thinks that a good formula for opal glass is a panacea against all troubles is bound to find sooner or later that he is mistaken. Proper temperature control and careful furnace management are just as important as maintaining the proper chemical composition of the batch.

Materials for Producing Opacity

The opal glass maker has the choice of a large number of substances to produce almost any degree of opacity. These include, magnesium silicates such as talcum and asbestos, phosphates, such as bone ash, calcium phosphate and sodium phosphate, tin oxide, titania, zirconia, and fluorides, such as cryolite, fluorspar, sodium silico fluoride and barium fluoride. Fluorides are now most widely used, and are in many instances replacing other materials.

Fluorides will only give satisfactory results as opacifying agents when used in conjunction with alumina. For this reason, cryolite, containing both fluorine and aluminum is the ideal material to produce opacity. This mineral may be regarded as the double compound of sodium fluoride and aluminum fluoride, containing about 60 per cent of the former and 40 per cent of the latter. It has the formula Na_3AlF_6, with 32.79 per cent Na, 12.85 per cent Al, and 54.36 per cent F. A similar mineral, which, however, is rarely used, is Chiolite, which is also a sodium aluminum fluoride, having the formula $Na_5Al_3F_{14}$, containing 28.8 per cent Na, 17.5 per cent Al, 57.7 per cent F, or about 40 per cent sodium fluoride and 60 per cent aluminum fluoride.

The largest known deposit of cryolite occurs in southern Greenland. It is a white, glassy, crystalline mineral, containing small amounts of impurities, principally silica as quartz, and sulphides of iron, zinc, copper and lead. The silica, which may range as high as four per cent, is of course not injurious to the glass, yet it is an undesirable element, as it decreases the amount of active fluorine, for which the material is bought.

The chemical industry can point to a number of instances where a synthetic product has taken a place besides the natural product, and in some cases has even replaced it. For a number of years synthetic cryolite has been produced in Germany, which is in every way identical to the natural mineral. Since its manufacture can be controlled carefully, it is produced in a high state of purity, and is practically free from iron. It can be made by digesting hydrate of

alumina with sodium fluoride, and also by dissolving hydrate of alumina in hydrofluoric acid, and precipitating the synthetic cryolite by the addition of common salt.

While there is absolutely no difference between the action in glass between the natural and the synthetic cryolite, a prejudice against the latter material has been created by manufacturers and dealers who sell mixtures of kaolin or feldspar with substances containing fluorine, such as fluorspar, or sodium silico fluoride. Such mixtures are not made according to the true formula for sodium-aluminum-fluoride. Their content of sodium-aluminum-fluoride is low and they contain non-combined aluminum fluoride which is of no value to the consumer because it will decompose at low temperature. While such substitutes may be safely used by those who know their composition, and who are familiar with their effect, yet their sale to glass manufacturers who do not understand their nature is to be deplored, as it causes a great deal of confusion. The opacity in glass depends on the amount of fluorine remaining in the finished product. By using natural or synthetic cryolite, a part of the fluorine combines with the silica in the batch to form silicon tetrafluoride, which escapes as a gas. On the other hand, sodium and aluminum, present in the cryolite combine with the oxygen of the silica, and are changed to sodium oxide and alumina. It has been found that about one third of the cryolite is decomposed in this manner, while the remaining two thirds go into the glass. Cryolite substitutes, however, are decomposed to a much larger extent, therefore amounts theoretically equivalent do not give the same opacifying action. On account of their lack of chemical stability, the use of these materials make the manufacturing process more difficult to control. Moreover, they are often diluted by considerable amounts of silica, or soda ash, which further decreases the amount of active substance, fluorine, for which the material is bought. For this reason manufacturers of opal glass as a rule prefer to use materials of stable, unchangeable composition, and specify either the Greenland mineral or synthetic cryolite.

On account of the high cost of cryolite, it is often partly or completely replaced by a mixture of fluorspar and feldspar. Most of the fluorspar offered to the glass industry contains about 95 per cent CaF, the chief impurity being silica, although calcium carbonate, iron and aluminum compounds may also be present.

Displacement of Labor by Machinery in the Glass Industry

From the Monthly Labor Review of the U. S. Bureau of Labor Statistics, Summarizing the Results of a Recent Investigation into Actual Conditions

In no other industry has the introduction of machinery had a more dramatic effect upon labor productivity than in the glass industry. Thus, to take an extreme example, in the blowing of 4-ounce prescription bottles, the average output per man is more than forty-one times as great with the automatic machine as with the hand processes which were in general use up to less than 20 years ago. This means a great reduction in the number of workers necessary to turn out a given quantity of product. It also means a great change in the character of the labor force. Instead of a group of very highly skilled glass blowers, assisted by a group of unskilled "boys," the automatic machine employs mechanics and machine operators, with little or no demand for child labor.

These revolutionary changes in the glass industry have taken place within a period of 25 years. The advent of the twentieth century found the glass industry in the United States still in the stage of hand production. With the exception of a few experimental semi-automatic machines used for the making of vaseline jars, the process of blowing bottles and other glassware was essentially the same as that used in Egypt some 3,500 years ago. In 1925, hand production had all but disappeared from the field. Its place was taken first by the semi-automatic and more recently by the automatic machines. The history of this change, and its effects on labor productivity and labor cost in the glass industry, are set forth in a bulletin soon to be published by the United States Bureau of Labor Statistics entitled, "Labor Productivity in the Glass Industry." The present article is a summary of that work.

Comparisons of Labor Output and Cost in Hand and Machine Production

How far-reaching these results have been will become self-evident from the following highly illuminating examples:

BOTTLES.—A hand "shop," consisting of 3 skilled workers (a gatherer, a blower, and a finisher) and 4 helpers, can produce on the average 3.75 gross of 4-ounce prescription ovals per hour. The 1925 average output of the most up-to-date Owens automatic machine was 69,754 gross of 4-ounce prescription ovals per hour. The average output of the hand shop is 0.536 gross per man per hour, while with the automatic machine the average is 22.028 gross per man per hour, or more than forty-one times as much as in the hand process.

Based on the 1925 wage rates, the direct blowing labor cost of a 4-ounce prescription oval made by hand would be $1.177 per gross. With the Owens automatic machine, the 1925 direct blowing labor cost of the same kind of bottle was 3.15 cents per gross. For every dollar spent on blowing a 4-ounce prescription oval by hand, the labor cost on the Owens automatic machine was but 2.70 cents.

PRESSED WARE.—In making 8-9 ounce common table tumblers on the side-lever press, a hand shop, consisting of 3 skilled workers (a gatherer, a presser, and a finisher) and 6 helpers, produced in 1925 an average of 278.96 pieces per hour, or 31 pieces per man per hour. The Hartford Empire twin press, operated with an automatic conveyor, produced in 1925 an average of 1,903.54 pieces per hour, or 380.71

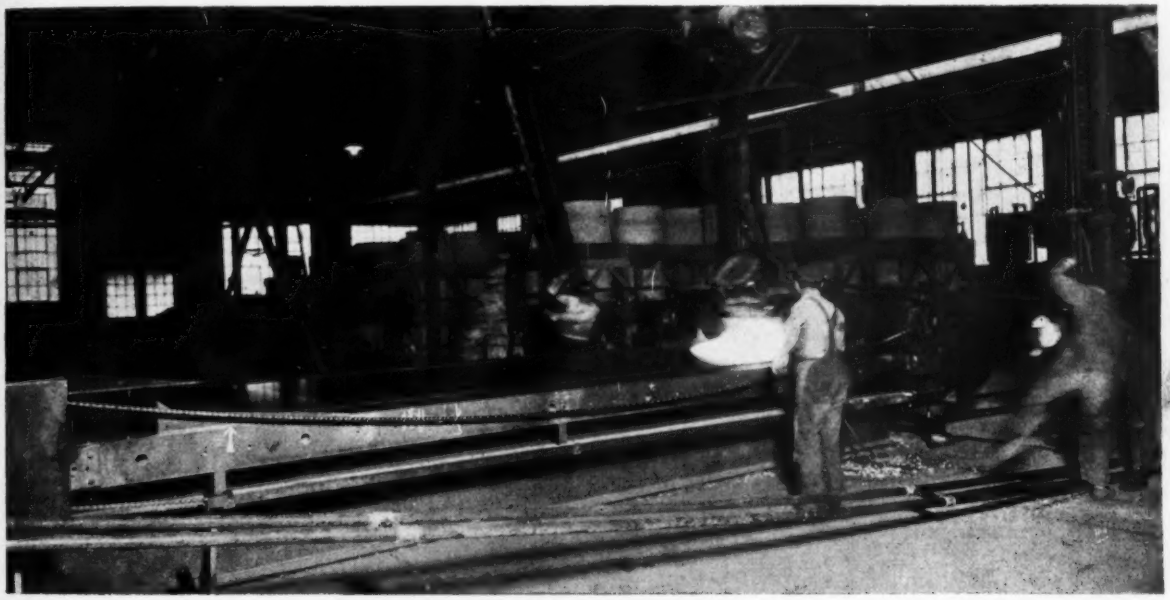
pieces per man per hour, more than twelve times as much as could be produced with the hand press. The direct labor cost of pressing 100 of these tumblers was with the hand press, $1.95 and with the automatic press, 13 cents. Thus, for every dollar spent on the direct labor of pressing common table tumblers by hand it cost but 6.7 cents to press them on the automatic machine.

ELECTRIC-LIGHT BULBS.—A hand shop, consisting of a gatherer and a blower, assisted by a section boy and a cutting-off boy, can produce on the average 121.98 40-watt electric-light bulbs per hour, or 54.21 pieces per man per hour. The 1925 average output of the new type Westlake automatic machine was 2,342.44 bulbs per hour, or 1,703.59 pieces per man per hour, more than thirty-one times as much as by the hand process. The average blowing labor cost by the hand process was $13.88 per 1,000 pieces, as compared with $0.470 by the machine process. The saving in labor cost effected by automatic machine was 96.61 cents on every dollar required for the hand process.

GLASS TUBING.—A hand shop, consisting of 4 skilled workers (a gatherer, a ball maker, a marverer, and a gaffer) and 4 unskilled helpers, can produce on the average 80.54 pounds of glass tubing, sizes 32 to 34, inclusive, or an average of 10.07 pounds per man per hour. In 1925, the Danner tube-drawing machine, working on the same sizes of tubing, produced on the average 300.70 pounds per hour or 75.17 pounds per man per hour, which is seven and one-half times as much as by the hand method. The blowing labor cost by the hand process averages $6.83 per 100 pounds, while with the Danner machine the cost is only $1 per 100 pounds. Thus, for every dollar spent for labor on blowing glass tubing by hand it costs but 14.7 cents to blow it by the Danner machine.

WINDOW GLASS.—A hand shop, consisting of one gatherer, one blower, and one snapper, can produce on the average 2.72 boxes, each containing 50 square feet of single-strength window glass, per hour, or 0.709 box per man per hour. On the Fourcault automatic machine, the average 1925 output was 7.68 boxes per hour, or 1.85 boxes per man per hour, more than two and a half times as much as by the hand process. The average direct blowing labor cost by the hand process was 95.5 cents per box, as compared with the average cost of 29.9 cents per box made on the Fourcault automatic machine, the use of the machine meaning in this case a saving of nearly 70 cents on every dollar spent for blowing by the hand process.

PLATE GLASS.—The output of casting rough plate glass by the discontinuous process, which is still prevalent in the industry, is 43.89 square feet per man per hour; by the continuous automatic process, recently introduced, the average is 63.63 square feet per man per hour, or 45 per cent more than by the old process. In the case of polished plate glass, the man-hour output by the discontinuous process averages 7.66 square feet, while that by the continuous process is 12.30 square feet, or 60.5 per cent higher. The total labor cost of casting rough plate glass by the continuous process is 25.1 per cent less than by the discontinuous process, and the total labor cost of making polished plate glass is on the average 43.3 per cent less than by the discontinuous process.



ROLLING PLATE GLASS ON THE CASTING TABLE
Reprinted from a previous issue.

Development of Machinery in the Industry

The glass industry is composed of a number of branches whose only common characteristic is the molten glass from which the respective commodities are made. The nature of the ware made and the methods of production, whether by hand or by machine, are entirely different in the separate branches. The development of machinery also has not been uniform and simultaneous in all the branches. To all intents and purposes, therefore, the five separate branches may be considered as independent industries manufacturing, respectively: Bottles and jars, pressed ware, blown ware, window glass, and plate glass.

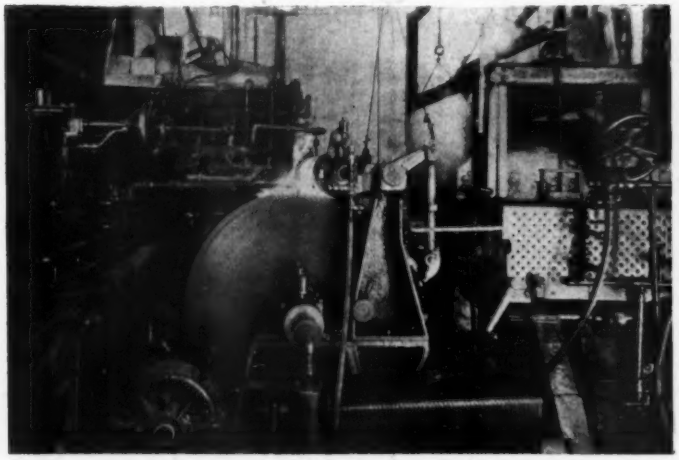
MANUFACTURE OF BOTTLES AND JARS

In his book, Machinery and Labor, Prof. G. E. Barnett, of Johns Hopkins University, distinguishes three periods in the development of machinery for the purpose of making bottles and jars: (1) 1898-1905, during which was developed semi-automatic machinery for the making of wide-mouth ware exclusively; (2) 1905-1917, characterized by the introduction of the Owens automatic machine for the making of all kinds of bottles, both wide and narrow mouth, and of semi-automatic machinery for the manufacture of narrow-mouth ware; (3) 1917 to date, during which time semi-automatic machinery has been made automatic by "feed and flow devices."

The first more or less successful semi-automatic machine was invented in 1882 by Philip Arbogast, of Pittsburgh, Pa., and 11 years later this machine was successfully applied for the purpose of making vaseline jars. In 1896, a similar machine was invented for the purpose of making Mason jars. The growth of the semi-automatic machine from 1897 to 1905, as shown by the number of machines in use in each of those years, is given by Professor Barnett as follows: 1897, 20 machines; 1898, 50 machines; 1899, 60 machines; 1900, 80 machines; 1901, 90 machines; 1902, 100 machines; 1903, 150 machines; 1904, 200 machines; 1905, 250 machines.

But the first really revolutionary change took place in 1904, with the successful introduction of the automatic machine, invented by M. J. Owens. This machine, where used, at once displaces all the skilled blowers and most of their helpers in the shops. The output of the new machine was so much greater and the cost of production so much less than by the hand and the semi-automatic processes, that had it not been for the restrictive policies of the owners of the Owens machine, these less economical processes would at once have been displaced by the automatic machine.

As it happened, however, the period of the Owens automatic machine was also the period of the development of semi-automatic machinery. In 1917, there were 200 Owens machines in operation in this country, but there were also in use 428 wide and narrow mouth semi-automatic machines. At about this time, also, the "gob" feeder, which had been experimented with for some time, became a commercial success. This appeared to have certain advantages over both the Owens automatic and the semi-automatic machines. In the course of the next eight years the majority of the semi-automatic machines were reconstructed and equipped with automatic feeders so as to become completely automatic. The Owens machine has also undergone a series of important changes, especially as to the number of arms and the number of molds on each arm. The most modern type of Owens machine has 15 arms, each equipped with two molds, and each mold containing cavities for two or three bottles, depending on the size of the bottle. At present, these automatic processes completely dominate the bottle-making industry. The semi-automatic process has disappeared entirely, but a small number of plants are still using the hand process for bottles which cannot be made more economically on the machine.



ROLLING PLATE GLASS BY THE FORD PROCESS
Reprinted from a previous issue.

FORD CONTINUOUS GLASS GRINDING MACHINES
Reprinted from a previous issue.

MANUFACTURE OF PRESSED WARE

Although the introduction of the side-lever press dates back to 1827, the general introduction of machinery in this branch of the industry took place much later and is less significant than that in the bottle industry. The side-lever press is still used in a large number of plants. During the first part of this century the semi-automatic rotary press was introduced, but the greatest change came with the introduction of feeding devices. Modern machines equipped with these devices are made after the pattern of the bottle-blowing machines, but are less complicated. They are used primarily for making pressed tumblers of all sizes, nappies and sherbets. The largest proportion of pressed ware, especially the so-called "novelties," is still, however, made either on the old-fashioned side-lever press or on the rotary press.

MANUFACTURE OF BLOWN WARE

In the field of blown ware, the development of machinery has been much more pronounced than in the case of pressed ware. The machines used are also more complicated and specialize in the production of some particular article, such as lamp chimneys, electric-lamp bulbs, punch tumblers, and tubes.

The lamp-chimney semi-automatic machine dates back to 1894. Since then it has undergone a number of changes, but on the whole very little progress has been made in this branch of the glass industry. Hand production, especially the off-hand method, is still an important factor, but the industry as a whole is diminishing in importance, as electricity is rapidly displacing the use of oil-burning lamps even in the most outlying and inaccessible districts.

On the other hand, the most amazing progress has been recorded in the making of electric-lamp bulbs. Since 1917, hand production has been almost entirely displaced, first by the semi-automatic Empire E machine, and more recently by the completely automatic Westlake machine and the Empire F machine operated with an automatic feeder. At present, more than 95 per cent of all the electric bulbs are made by the two automatic processes. The semi-automatic machine has been almost completely abandoned, while a few hand shops have been retained for experimental purposes, or for the purpose of making oddly shaped and colored electric bulbs.

THE WESTLAKE MACHINE

The Westlake machine, which revolutionized the bulb-making industry, has also recently invaded the field of punch tumblers. These are now made either on the Westlake machine or as a byproduct on the lamp-chimney semi-automatic machine. Only the most expensive tumblers, those decorated with special designs, are still made by the hand shops.

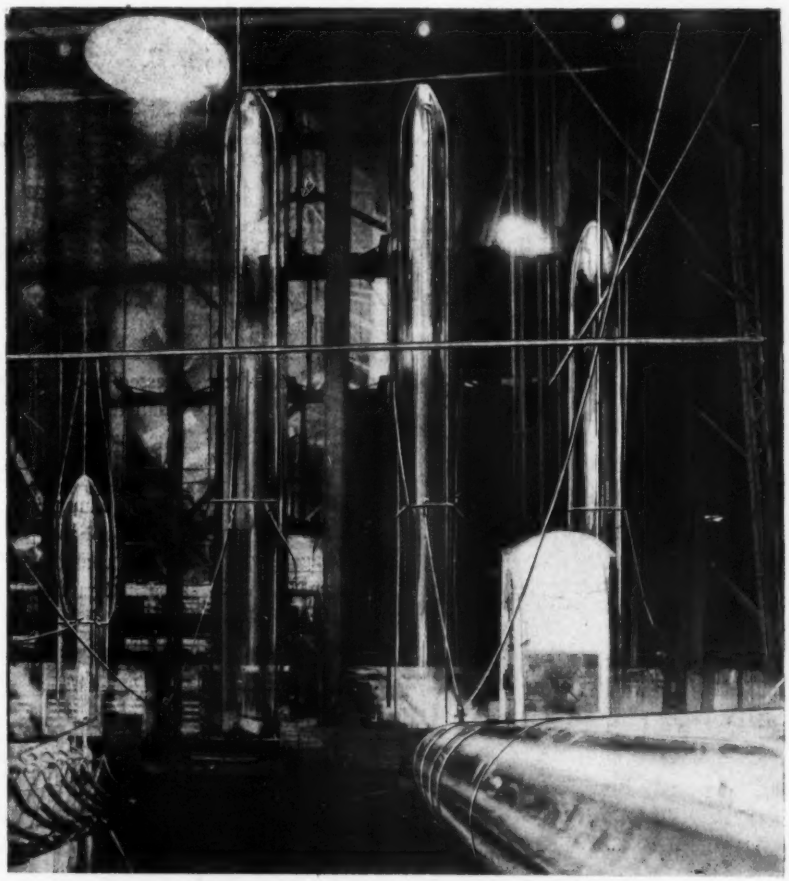
The year 1917, which brought with it so many revolutionary innovations in the bottle and pressed and blown ware branches of the industry, witnessed also the introduction of the Danner machine for the making of glass tubing. The new method was so superior to the old hand process that, in the comparatively ort period of less than eight years, it so thoroughly displaced the old process that not a single shop can now be found making glass tubing by hand.

MANUFACTURE OF WINDOW GLASS

The introduction of the Lubber cylinder machine in 1905 was the first successful attempt to replace by machine the hand process of making window glass. The cylinder process may be called semi-automatic, as considerable handling of the glass is required in the various stages of its journey from the tank to the cutter's table. In 1917, the Colburn process of automatically drawing a continuous sheet of glass from the tank became a commercial success, while in 1921 the Fourcault automatic process, invented in Belgium, was successfully introduced into this country. As a result very little window glass is at present made in this country by the hand process. The cylinder machine is still the dominating factor in the industry, but the improved Colburn process and more recently the Fourcault machine have been rapidly gaining on the cylinder process and are becoming very important.

MANUFACTURE OF PLATE GLASS

The story of plate glass is essentially different from that of any other branch of the glass industry. It has been from the very beginning a nonskilled industry, and the many simple operations involved in the process of handling the large and heavy plates soon suggested the use of labor-saving devices. When the industrial revolution finally reached the other branches of the glass industry, plate glass had already become a progressive, well-integrated industry. Recently, however, the introduction of the continuous tank and the automatic process of casting rough plate, and the conveyor method of grinding and polishing the plates, have tended to bring about changes in the plate glass branch almost as revolutionary as those in the other branches of the industry. The continuous process has not yet reached the stage of unquestioned superiority over the older so-called discontinuous process, and some time will probably elapse before the industry universally adopts the new process.



DRAWING WINDOW GLASS CYLINDERS
Reprinted from a previous issue.

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Effects of Automatic Machinery on the Industry

In view of the tremendous changes in man-hour output and labor cost due to automatic machinery, it may be worth while to examine more or less in detail the effects of the introduction of machinery on the industry as a whole. Table 1, compiled from census reports, shows the growth of the industry from 1899 to 1925 (the period during which the change from hand production to semi-automatic and automatic machinery took place) for the industry as a whole, and also, where available, for the four principal branches whose combined output constitutes more than 90 per cent of that of the industry.

TABLE 1—DEVELOPMENT OF THE GLASS INDUSTRY, IN SPECIFIED YEARS, 1899 TO 1925

Item	1899	1904	1909	1914	1919	1921	1923	1925
Total number of establishments	355	399	363	348	371	329	333	310
Bottles and jars	147	158	166	150	145	(*)	117	120
Pressed and blown ware	84	103	114	107	130	(*)	127	123
Window glass	100	103	(*)	64	79	(*)	65	42
Plate glass	16	17	(*)	19	17	(*)	17	19
Total number of wage earners	52,818	63,969	68,911	74,502	77,520	54,748	73,335	69,371
Bottles and jars	28,370	(*)	(*)	(*)	(*)	(*)	24,010	21,704
Pressed and blown ware	12,546	(*)	(*)	(*)	(*)	(*)	27,196	21,507
Window glass	8,682	(*)	(*)	(*)	(*)	(*)	8,826	8,346
Plate glass	3,220	(*)	(*)	(*)	(*)	(*)	9,961	11,124
Output:								
Bottles and jars—thousand gross	7,780	12,005	12,316	19,290	22,295	(*)	28,393	26,044
Pressed and blown ware—million pieces	360	428	532	701	1,080	(*)	(*)	1,963
Window glass—thousand boxes	4,341	4,852	6,922	8,020	7,380	5,201	10,204	11,343
Plate glass—thousand square feet	16,884	27,293	47,370	60,384	56,823	56,239	94,470	17,369
Value of output (000 omitted)	$56,540	$79,608	$92,095	$123,085	$261,884	$213,471	$309,353	$295,959
Bottles and jars	21,677	33,631	36,018	51,959	94,670	(*)	107,231	100,301
Pressed and blown ware	17,076	21,956	27,398	30,279	70,749	(*)	77,279	72,085
Window glass	10,879	11,611	11,743	17,495	41,101	24,026	42,623	37,525
Plate glass	5,159	7,978	12,205	14,774	33,348	37,261	66,103	57,207
Wages (000 omitted)	27,084	37,288	39,300	48,656	87,527	68,224	89,898	86,736

(*) Not reported.

ESTABLISHMENTS AND WAGE EARNERS

As shown in the table, the glass industry in 1899 comprised 355 establishments, employing 52,818 wage earners, an average of 149 wage earners per establishment; in 1925 there were only 310 establishments, but these employed 69,371 wage earners, an average of 24 wage earners per establishment. In the course of the 25 years, the number of establishments decreased 12.7 per cent, while the number of wage earners increased 31.3 per cent, and the average number of wage earners per establishment increased 50.3%.

The figures for the industry as a whole, however, do not tell the story of what happened in the separate branches. In the bottle and jar branch, the general adoption of the automatic machines resulted not only in a diminution of the number of plants and wage earners in the industry, but also in a decrease of the average number of wage earners per establishment. Fewer workers are seen in a large up-to-date machine bottle plant than in a small hand plant. In the pressed and blown ware branch the automatic machines have so far invaded only a small part of the industry, and this branch has an increased number of plants and wage earners, as well as an increase in the average number of workers per establishment. In the window-glass branch, the predominance of the cylinder-machine process has cut the number of establishments over half, somewhat diminished the total number of wage earners, and increased the average number of wage earners per plant nearly one and one-third times. In the plate glass industry, which until very recently witnessed no revolutionary changes, the growth of industry more than tripled the number of wage earners and nearly tripled the average number of workers per establishment.

SIZE OF ESTABLISHMENTS

The number of workers employed and the average number per establishment cannot, however, be used as an indication of the change in the size of the establishment, for the reason that the primary object of the introduction of machinery has been to decrease the number of wage earners employed. This is especially true of the bottle and jar branch of the industry.

THE LIBBEY-OWENS SHEET GLASS DRAWING MACHINE
Reprinted from a previous issue.

A better means of measuring the size of an establishment may be found either in the quantity or the value of output. For a period of years the quantity of output is more effective, as it remains more or less untouched by changes in prices, which exert a disturbing influence on the value of the output.

In 1899, the average output per establishment in the four branches was: Bottles and jars, 52,925 gross; pressed and blown ware, about 4,286,000 pieces; window glass, 43,410 boxes; and plate glass, 1,055,200 square feet. In 1925 it was: Bottles and jars, about 217,000 gross; pressed and blown ware, 15,959,000 pieces; window glass, 270,100 boxes, and plate glass, 6,177,000 square feet. Thus, in 1925, the average output per establishment was 4.1 times as much as in 1899, in the case of bottles and jars; 3.7 times as much in the case of pressed and blown ware; 6.2 times as much in the case of window glass, and 5.9 times as much in the case of plate glass.

The distribution of total number of establishments and the value of their output on the basis of the value of output in each establishment is even more significant of the changes in the size of establishments than the actual output per establishment. Table 2 shows the total number of establishments in 1904* and 1925 divided according to the value of the yearly output.

TABLE 2.—NUMBER OF ESTABLISHMENTS IN THE GLASS INDUSTRY AND VALUE OF THEIR PRODUCT, 1904 AND 1925, BY CLASSIFIED VALUE OF PRODUCTS.

Establishments with yearly value of product of—	Number of establishments		Total value of product	
	1904	1925	1904	1925
Under $100,000	164	49	$8,341,000	$2,652,000
$100,000 and under $1,000,000	230	178	62,274,000	78,754,000
$1,000,000 and over	5	83	8,993,000	214,553,000
Total	399	310	79,608,000	295,959,000
	Per cent			
Under $100,000	41.1	15.8	10.5	0.9
$100,000 and under $1,000,000	57.6	57.4	78.2	26.6
$1,000,000 and over	1.3	26.8	11.3	72.5
Total	100.0	100.0	100.0	100.0

As shown in the table, the tendency has been for the manufacturing units to become steadily larger. Thus in 1904 only 11.3 per cent of the total value of all glass products was produced in plants with annual products valued at $1,000,000 or over. In 1925 this percentage had grown to no less than 72.5.

Prior to the introduction of machinery, the glass industry was predominately a small-unit industry. The amount of capital needed for a plant was small, and the principal item of expenditure, outside of labor, was fuel. A cheaper rate on coal or natural gas was enough of an inducement for the removal of a glass plant from one locality to another and from State to State. The history of the discoveries of natural gas in Pennsylvania, Indiana, West Virginia and Oklahoma also tells the story of the migrations of the glass industry to and from these States.

But with the advent of machinery, the situation changed completely. Fuel is still a very big item in the cost of production of glass, and is still considered as the factor determining the site of a new glass establishment. But once the plant is built, the capital outlay on the building, the furnaces, and the machines, and other items prevent the moving of the establishment irrespective of the cost of fuel. Thus, as migration was eliminated, the advantages of large-scale production were at once brought into play, with the result that in the short span of 25 years, the glass industry has been converted from a small and loosely connected industry into a large and well-integrated one.

[The concluding portion of this article will be given in an early issue: It treats of Output and Productivity; Value of Output; Wage. Workers' Earnings; Child Labor in Industry.—Ed.]

FOURCAULT SHEET GLASS DRAWING MACHINES AND TANKS
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*Data are not available for 1899.

The Glass Industry

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CONTRIBUTIONS

THE EDITOR welcomes practical articles on all subjects related to GLASS MANUFACTURING. Such articles, if accepted, will be paid for at our usual rates.

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Preparedness for Progress

Progress in industry is an accelerated process: its velocity rate increases with every new development made. In the glass industry the past quarter of a century has brought greater advances than have occurred in all the ages which preceded the year 1900. The next twenty-five years promise to exceed greatly those just past, in the way of advancement.

The last few years have brought to the glass industry a considerable number of important new developments. We now have a definite promise of a satisfactory solution of the refractories problem. First one new refractory material appears, then another, and then still another. Many are working towards the same goal, and several reach it in their own way.

Only a few years ago, the glass annealing lehr was a cumbersome brick tunnel, consuming a large quantity of heat and most difficult to regulate. It took from six to eight hours until the ware was annealed, and even then results in many cases were unsatisfactory, due to variations in temperature impossible to control. Dissatisfaction with existing conditions compelled technical men to make a thorough investigation of the annealing process. Preconceived notions were thrown overboard. It was evident that the underlying principle governing annealing was misunderstood. Serious thought was given to evolve a correct theory of the annealing process.

Theories were tested until reasonable certainty existed that the true nature of annealing was grasped. Then engineers went to work on the newly established basis, and success became a certainty. A scientific conception was put in the place of a hit-and-miss method, with results that astonished the layman, but which confirmed the confidence that the technically trained man has learned to put in the scientific method.

In 1925 announcement was made in this journal of the invention of the electric lehr, making close temperature regulation possible and reducing the time necessary for perfect annealing to one hour and thirty-five minutes. For certain kinds of glassware, the success of this method of annealing has proven to be worth its cost, even in places where electricity is not cheap.

Shortly afterward the Hartford-Empire lehr made its appearance. The invention of this lehr, often referred to as the "heatless lehr," due to its low fuel consumption, for a time appeared to absolutely dominate the field to which it was applicable. However, others were thinking and working and experimenting. The Shackelford-Mayo full automatic, fuelless lehr was put into operation some months ago with very gratifying results.

The Amsler-Morton Company has developed a new unit lehr, able to take care of a very large production with a low fuel consumption and greatly reduce the time required for annealing. The Simplex Engineering Company has just announced an electric, gas or oil lehr having a number of highly interesting features.

All of these new developments call for executive and technical ability of a high order on the part of those guiding the destinies of glass factories. They make the existence of a

trained technical staff a necessity, to enable the factory executive to select the proper equipment for his particular purpose. The need exists, and is growing more pressing every day, of being prepared for sudden changes of a revolutionary nature in processes and equipment.

Various industries have been almost completely revolutionized by new processes, which have appeared almost over night. The continuous plate glass process, and the manufacture of plate glass by the Libbey-Owens system are illustrations of what has happened in one branch of the glass industry.

There are persistent rumors of experimental work now being done to make glass by an exothermic reaction, which if feasible may enable the manufacturer to produce glass with a minimum amount of heat. Important changes in furnace design are impending; among others, a process and equipment for melting glass by electricity has been developed by experiment on a commercial scale in Norway.

The glass manufacturer of today, in the battle for existence, should be prepared financially and from an engineering point of view to adjust his organization to make rapid moves for meeting changing conditions. This applies to engineering, equipment, methods of glass melting, furnace design and management. Unless this ability is developed, he may be left as high and dry as those who have stuck to the antiquated methods of making window glass by hand, instead of reading the handwriting on the wall, and adopting mechanical methods of window glass production. Success will be on the side of those who are best able to visualize the future of their industry.

Tariff Commission Corrects Error

The United States Tariff Commission has issued a notice under date of April 16, 1927, announcing that in the Preliminary Statement of Information on the Cost of Plate Glass issued on March 25 (published in our April issue on page 86) there was an error in table 26 giving costs of materials and of the batch in the United States for certain years. The figures given in dollars for the United States actually represented the cost of only 1,000 pounds instead of short tons as stated at the top of the table. The correct figures are given in the revised table below.

The costs of raw materials, tables 13 and 14, are not affected by this change, nor are the figures in other portions of the statement.

Technical Consultation Service

THE GLASS INDUSTRY invites its readers to refer to this department any problems with which they may be confronted pertaining to raw materials, glass technology, laboratory and factory practice. While making no pretensions to the possession of unbounded knowledge or infallibility THE GLASS INDUSTRY is ready to assist its readers to the best of its ability in solving their problems. Readers who can offer better suggestions than those printed are invited to submit them. All inquiries will be treated confidential.

Etching Trade Marks on Glassware

QUESTION 107—We have from time to time, occasion to etch trade marks or other printed matter on glass reflectors and have had difficulty in securing a satisfactory etching ink or process of applying same so that a clean-cut etch will be obtained. It is very evident, therefore, that either the etching solution we are using or the stamps we are using to apply this ink are not satisfactory.

It has been observed that a very clean-cut etch is obtained on electric lamp bulbs and we are wondering if you can give us information regarding the method used.

ANSWER—1. Preparation of etching ink for use with rubber stamps.

Make up a concentrated solution of ammonium fluoride in hydrofluoric acid, using a lead vessel or a container lined with rubber or wax. The acid is very corrosive and attacks the skin badly. For this reason it is important to use rubber gloves, and to do the work either in the open air, or in a well ventilated hood. Breathing of the acid fumes should be avoided.

The liquid obtained as above can be transferred to a pad in small amounts as needed, and the rubber stamp is moistened on the pad in the same way as when ordinary ink is used. The stamp is then pressed on the glass. Or it may be advisable to put the stamp in a fixed position and to press the glass object onto the stamp.

2. Preparation of etching paste, for use with rubber stamps.

Prepare silica-gel by adding hydrochloric or sulphuric acid to water glass. Mix 5 parts by weight of ammonium fluoride, 1½ parts of potassium sulphate and 1 part of sulphuric acid with a suitable amount of silica-gel, so that a pasty mass is obtained which is not too thick in consistency. This paste is transferred to the glass with a rubber stamp. The etching process goes on slowly and is finished in about 24 hours. It is advisable to put the objects in a warm place, as the intensity and speed of the etching depends on the temperature. This process gives a beautiful frosting, but is too slow for most purposes.

3. Preparation of etching grease, for use with rubber stamps.

With the aid of a rubber stamp transfer a grease of animal or vegetable origin to the glass, and dust it with etching powder. Remove the parts of the design which should not be frosted, and put the object in a warm place. The grease will soften and the frosting process proceeds.

Etching powder is made by mixing 10 parts by weight of ammonium fluoride, 2 parts of sodium chloride (common salt) and one part of soda ash.

Another method of producing an etched finish on glass is by means of sand blasting, using powdered glass or fine silica sand as the sand blasting medium and a very soft rubber stencil.

TABLE 26. (Revised)

Cast polished plate glass, United States and Belgium: Comparison by years of prices of principal raw materials, and of total batch. Per short ton

Ingredients of Batch	1923				1924				1925				
	United States	Belgium			United States	Belgium			United States	Belgium			
	Dollars	Francs	Dollars[1]	Dollars[2]	Dollars	Francs	Dollars[1]	Dollars[2]	Dollars	Francs	Dollars[1]	Dollars[2]	Dollars[3]
Sand	4.40	13.81	0.82	0.91	5.12	18.10	0.84	0.88	4.46	18.27	0.89	0.87	0.95
Soda	29.18	350.20	20.91	23.12	31.22	408.26	18.85	19.95	31.16	401.67	19.62	19.14	20.91
Saltcake	23.98	334.65	20.64	22.35	24.22	442.17	20.41	21.69	24.90	349.68	17.11	16.66	18.29
Lime	3.56	28.36	1.74	1.92	4.24	32.38	1.49	1.59	4.26	34.52	1.69	1.64	1.81
Batch	10.10	86.93	5.02	5.79	11.00	110.27	5.03	5.40	9.96	96.85	4.69	4.61	5.01

[1] Belgium prices in dollars by the method of conversion from francs employed in Table 18. (Method No. 1)
[2] Belgium prices in dollars by the method of conversion from francs employed in Table 19. (Method No. 2)
[3] Belgium prices in dollars by the method of conversion from francs employed in Table 20. (Method No. 3)

Recent Patents

NEW INVENTIONS DESIGNED TO IMPROVE GLASS AND THE MEANS OF PRODUCING IT

Complete copies of U. S. Patent Specifications may be obtained from the Commissioner of Patents, Washington, D. C. Price 10c each

Patent Invalid for Want of Adequate Disclosure

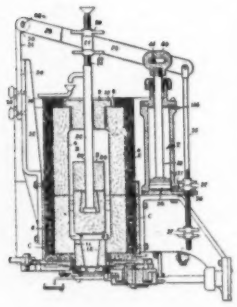
The United States District Court of Appeals for the Third Circuit in the suit of R. H. Comey vs. Monte Christi Corporation affirmed the decision of the District Court which held invalid claims 1 and 2 of patent 1,000,298, issued August 8, 1911, to Leopold Sarason.

The invention, specifically, was stated to be a preparation for slowly liberating oxygen from compounds, such as the peroxides, perborates, etc., in which the oxygen is loosely combined, by adding sodium pyrophosphate to the compounds.

The evidence showed that a chemist, relying on the disclosure of the patent, could not secure the results stated therein, even after experimentation.

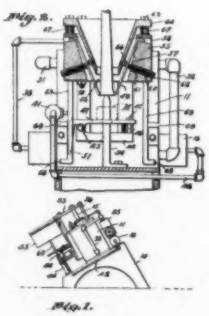
In affirming the decision of the District Court the Circuit Court pointed out that inasmuch as the disclosure is inadequate, the patentee had not paid in information the price for a patent monopoly.—*Industrial & Engineering Chemistry.*

APPARATUS FOR PRODUCING MOLD CHARGES OF MOLTEN GLASS, U. S., 1,621,426. March 15, 1927. William J. Miller, Swissvale, Pa., Assignor to Hartford-Empire Co. Filed 9/23/19. In apparatus for feeding molten glass in a succession of mold charges, the combination with a receptacle for molten glass provided with a discharge outlet, of a vertically reciprocating implement working in the glass in said receptacle to control the discharge of glass through said outlet without seating at the outlet, means for imparting a reciprocating movement to said implement, means for limiting the reciprocating movement of said implement comprising an element moving in unison with said implement and adjacent to an abutment, and adjustable stop members at opposite sides of said abutment to limit the motion of said element relative to the abutment.



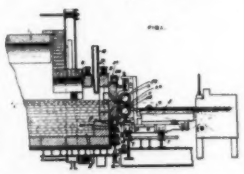
GLASS—FEEDING MECHANISM. U. S. 1,618,271 Feb, 22, 1927. Albert N. Cramer, Toledo, O., assignor to the Owens Bottle Co. Filed 2/23/21. Improved means to adjust the plunger of a glass feeding mechanism up and down while the apparatus is in operation; and improved adjustable cam for regulating and timing the movements of the plunger; and improved means for adjusting and regulating and timing of the several operations relative to each other and relative to the glass forming machine or machines with which the feeder is used.

APPARATUS FOR REMOVING WASTE GLASS FROM BLOWPIPES. U. S. 1,623,581. Apr. 5, 1927. John L. Dunnock and Clarence R. Nixon, Baltimore, Md. Filed 5/11/26. In a moil removing machine, a knife head, a series of knives supported by said head and having cutting ends, said knives being mounted to contract with a blow pipe inserted between them, means to reciprocate said head and knives, and means controlled by the insertion of a blow pipe in the machine for effecting operation of the head reciprocating means.



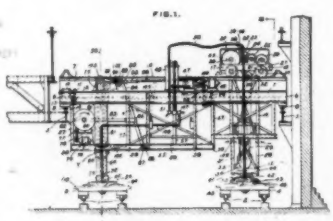
GLASS DRAWING AND APPARATUS THEREFOR. U. S. 1,622,417. Mar. 29, 1927. Walter E. Buzby, Wichita Falls, Tex. Filed 4/7/25. In the art of drawing glass cylinders, the method of compensating non-uniformity of temperature conditions of the surface of the bath which comprises the utilization of a bait non-symmetrical circumferentially as to bath chilling characteristics and the initial setting of said bait whereby a cooler portion of the bath will be less chilled than a hotter portion at the initiation of the draw.

GLASS TANK CONSTRUCTION. U. S. 1,622,346. Mar. 29, 1927. John Rotheram, Creighton, and Albert E. Evans, Pittsburgh, Pa., assignors to Pittsburgh Plate Glass Co. Filed 7/20/26. The combination with a tank adapted to carry a bath of molten glass, and rolling means at one side thereof for forming a sheet or ribbon of glass, of a clay outlet member intermediate the glass bath and the rolling means provided with an outlet slot for conducting the glass to the rolling means, a pair of hollow metal beams extending along the upper and lower edges of the outlet member and adapted to support such member and means for circulating a cooling fluid through said beams.



APPARATUS FOR FEEDING MOLTEN GLASS. U. S. 1,622,666. Mar. 29, 1927. Karl E. Peiler, West Hartford, Conn., assignor to Hartford-Empire Co. Filed 3/31/25. In combination with the outlet of a container for molten glass, an outlet structure including a frusto-conical refractory discharge nozzle, a heat-radiating element surrounding the nozzle and spaced therefrom, electrical heating means carried by the heat-radiating element, and a refractory casing member spaced from and surrounding the heat-radiating element.

APPARATUS FOR HANDLING GLASS SHEETS. U. S. 1,622,380. Mar. 29, 1927. Halbert K. Hitchcock, Pittsburgh, Pa., assignor to Pittsburgh Plate Glass Co. Filed 6/9/26. Designed particularly for picking up glass plates from one car or carrier upon a track, lifting it vertically from the said car or carrier high enough to clear the workmen, then carrying it laterally above the workmen to a position above a second car or carrier on a second parallel track and depositing it on a second handling apparatus, that turns the glass plate over, lowers it, and deposits it onto the second car or carrier.



GUIDING DEVICE FOR MOLTEN GLASS. U. S. 1,619,432. Mar. 1, 1927. Vergil Mulholland, West Hartford, Conn., assignor to Hartford Empire Co. Filed 1/6/22. A device for guiding molten glass into a mold, comprising a deflector mounted on a universal joint, and means actuated by the mold for positioning the deflector in delivering relation to varying mold positions.

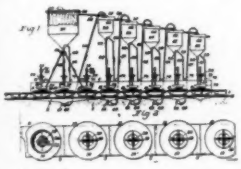
GLASS FEEDER. U. S. 1,618,313. Feb. 22, 1927. Leonard D. Soubier, Toledo, O., assignor to the Owens Bottle Co. Filed 3/3/24. One object is to provide means for periodically varying the speed of rotation of the regulator in synchronism with its vertical movements. The speed of rotation of the regulator may be either accelerated or decreased at any desired period during its cycle of movements, depending upon the results desired.

GLASS-WORKING MACHINE. U. S. 1,621,359. March 15, 1927. John T. Fagan and John J. Malloy, Cleveland, O., assignors to General Electric Co. Filed 2/7/21. In a glass working

machine, means for holding each end of a glass tube blank, means for successively advancing a series of said holders, means for aligning said blanks relative to each other, means for continuously and synchronously rotating said holders during their advancement, means for heating the rotating blanks locally and means for applying a gradual pull longitudinally of the said heated blanks whereby a contraction is formed on each of said blanks.

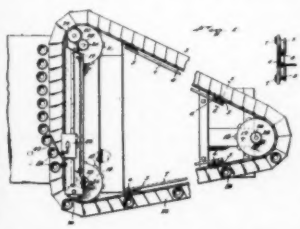
METHOD AND DEVICE FOR MANUFACTURING PLATE GLASS. U. S. 1,621,144. March 15, 1927. Lambert von Reis, Herzogenrath, Germany. Filed 4/28/26. The method of manufacturing plate glass, which consists in rolling the glass mass into plates with flutes on at least one of their surfaces, depositing the plates with a fluted surface on a conveyor having a supporting face provided with flutes in a direction different from the direction of the flutes on the glass plates, and carrying the latter by means of the conveyor to an annealing kiln.

METHOD AND APPARATUS FOR GRINDING GLASS. U. S. 1,622,091. Mar. 22, 1927. James W. Cruickshank, Pittsburgh, Pa., assignor to J. W. Cruickshank Engineering Co. Filed 10/20/23. The method of grinding glass by the continuous process wherein the glass is moved under a series of grinders requiring successively finer grades of sand, which consists in grading the sand in a series of compartments, each of which retains the coarser material applied thereto and delivers the finer to the next succeeding compartment, supplying successive grinders with sand from the successive compartments, and flowing the sand from each grinder to the next succeeding compartment, whereby the sand, as it is broken down in the successive grinding operations, travels through successively fewer grading compartments.



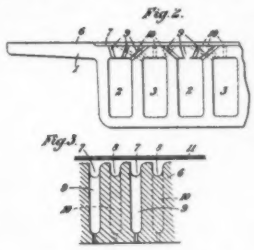
MEANS FOR FORMING AND DELIVERING CHARGES OF MOLTEN GLASS. U. S. 1,623,362. Apr. 5, 1927. John F. Rule, Toledo, O., assignor to the Owens Bottle Company. Filed 8/22/21. In one form of the invention the gob shaping means comprises a pair of rolls suitably recessed to form a shaping cavity or mold through which the gob is passed and by which it is shaped during its passage to the mold, said shaping rolls being also arranged to move downwardly and forwardly with the gob, whereby the downwardly moving gob is advanced with the traveling mold and accurately guided into the mold.

CONVEYOR FOR LEHR-CHARGING APPARATUS. U. S. 1,623,247. Apr. 5, 1927. Fred H. Johnson and Sherman R. Lathrop, Sapulpa, Okla. Filed 3/19/25. The conveyor comprises an endless chain consisting of plates set on edge so as to work in vertical planes and pivotally connected at their adjacent side edges. The chain is supported in its vertical position by flanged or grooved rollers which are arranged at intervals in pairs with the members of the pairs vertically alined so as to engage the upper and lower edges respectively of the several chain plates, the rollers being mounted upon connecting plates or brackets which are rigidly secured to upper and lower horizontal bars.



LEHR-CHARGING APPARATUS. U. S. 1,624,250. Apr. 12, 1927. Fred H. Johnson and Sherman R. Lathrop, Sapulpa, Okla. Filed 3/19/25. In an apparatus for the purpose set forth, the combination of a main conveyor, a carrier arranged in proximity to the main conveyor, an unloader blade pivoted at one end to the carrier and extending laterally therefrom across the conveyor whereby to push articles laterally from the conveyor, means for causing travel of the carrier longitudinally of the conveyor, and means mounted upon the carrier and connected with the unloader blade for yieldably holding it across the conveyor.

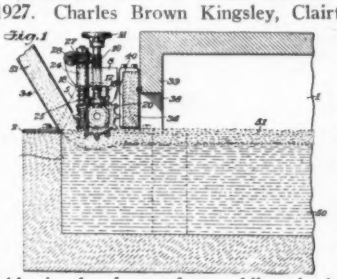
METHOD AND APPARATUS FOR PRODUCING A CONTINUOUS STRIP OF GLASS. U. S. 1,622,817. Mar. 29, 1927. Frederic Barnes Waldron, Prescott, England, assignor to Pilkington Brothers, Ltd. Filed 11/1/24. In apparatus for producing continuous strip of glass, means operative to prevent the glass coming into contact with the bed, consisting of a layer of air in motion between the glass and bed through which the latter air is supplied and mainly removed, and characterized by a plurality of grooves in the surface of the bed, arranged in two series, the grooves of each series alternating with those of the other series, the grooves of one series serving to conduct air to the layer and the grooves of the other series serving to conduct air from the layer and a plurality of holes extending through the bed from each groove, the said holes serving to conduct air to or from the groove.



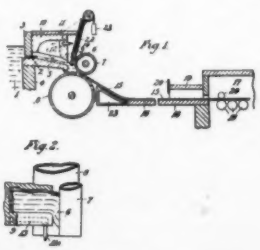
PROCESS OF GRINDING AND POLISHING GLASS AND APPARATUS THEREFOR. U. S. 1,621,296. March 15, 1927. Frederic Barnes Waldron, Prescot, England, assignor to Pilkington Bros. Ltd. In the continuous process of the abrasive treatment of glass involving the traveling of the glass, traveling a plurality of runners in the same direction as the glass and varying the supply of media for said treatment by each runner at successive stages of travel of that runner so as to produce an action of each runner of the plurality varying with and adapted to the condition of the glass on which it is operating.

PROCESS OF POLISHING GLASS AND APPARATUS THEREFOR. U. S. 1,621,297. Frederic Barnes Waldron, Prescot, England, assignor to Pilkington Bros., Ltd. Filed 11/11/24. In the process of continuous polishing of glass, moving the runners in the direction of motion of the glass at a constant speed different from that of the glass and treating their polishing surfaces successively with different treatments at different stages of travel of a runner.

BATCH FEEDING TO GLASS TANKS. U. S. 1,623,057. Apr. 5, 1927. Charles Brown Kingsley, Clairton, Pa., assignor to Mississippi Glass Company. Filed 5/14/25. Means are provided for continuously feeding the cullet from the storage bin or suitable feed hopper comprising a conduit or closed top chute which discharges through an opening in a cover on the dog house or receiving troughs of the tank at a point near means preferably in the form of a paddle wheel, in the form of a hollow cylinder for passing a current of air or water therethrough for the cooling of the cylinder and lugs, the paddle wheel serving both to impel the cullet into the molten glass and also to close the discharge end of the chute and prevent the raising of dust during the feeding.



PROCESS OF AND APPARATUS FOR ROLLING GLASS. U. S. 1,622,040. Mar. 22, 1927. Ernest Bristow Le Mare, St. Helens, England, assignor to Pilkington Brothers, Ltd. Filed 2/23/24. The molten glass flows along a chute or other conduit and forms a pool of molten metal in the approach to the pass of a rolling apparatus, that is to say, in the V-shaped space bounded by the two members of the rolling apparatus. The strip of glass issuing from the pass of the rolling apparatus, passes over a flat stationary bed and then into a lehr where it is supported on rollers which are turned at a peripheral speed slightly in excess of the speed at which the strip issues from the pass, so that the strip is subjected to a small tractive effort from its point of issue from the pass.



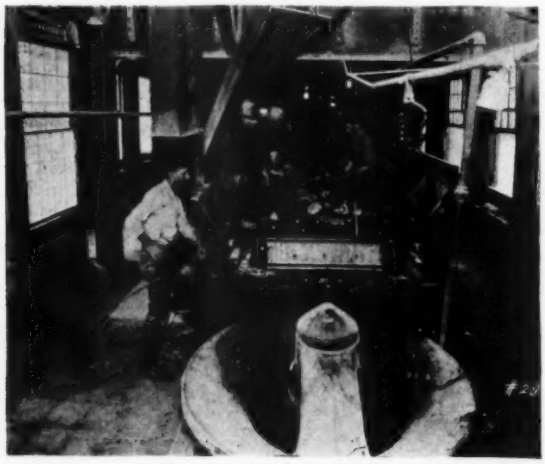
Glass Factory Equipment and Supplies

Most of the information printed in this department comes direct from the manufacturers of the products described.

Fluorspar—Its Mining and Markets

By E. L. BROKENSHIRE*

Fluorspar is calcium fluoride in a ratio of one molecule of calcium to two of fluorine. By weight it is composed of 51.3 per cent of calcium and 48.7 per cent of fluorine. It has a specific gravity of 3 to 3.25; is brittle, having a hardness of 4 and is easily scratched by a knife. In color fluorspar ranges from pure white and opaque white to various hues of yellow, green, pink, lavender,



PICKING BELT AND CRUSHER

blue, brown to bluish black. It crystallizes in the isometric system with perfect octahedral cleavages.

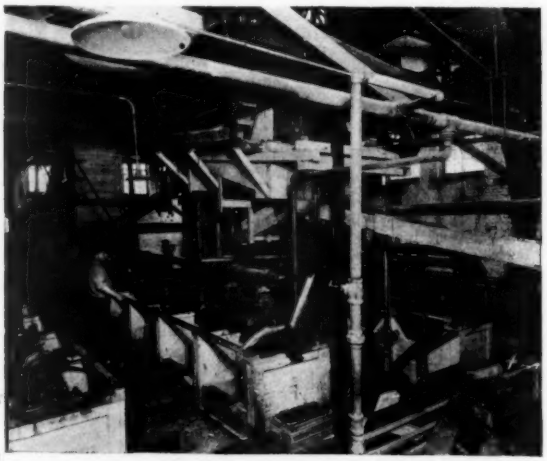
Deposits of fluorspar in the United States of known commercial importance are confined to four states, Illinois, Kentucky, Colorado and New Mexico. Of these Illinois and Kentucky supply 80 to 85 per cent of the total production. This district lies north and south of the Ohio River in Hardin and Pope Counties, Illinois, and Crittenden, Livingston and Caldwell Counties, Kentucky. In Colorado there are two producing properties and in New Mexico several small operations producing intermittently. New Hampshire, California, Arizona, Nevada, Texas and Utah have produced fluorspar but their combined yearly contribution is negligible.

During 1925 a total of 162,369 short tons were shipped to consumers in the United States of which domestic producers supplied 113,669 tons, the remainder (48,700 tons or 30 per cent) came principally from England, Germany and South Africa with lesser amounts from Belgium, China, France and Italy.

Imported fluorspar finds its market principally along the Atlantic coast although some tonnages at times reach Pacific coast ports. The bulk of the Illinois-Kentucky production is consumed west of the Appalachian Mountains. Western fluorspar is consumed principally in the west but occasionally reaches as far east as Chicago.

The steel industry uses from 80 to 85 per cent of the total American consumption in the manufacture of open hearth steel. It functions as a slag thinner and hastens and assists the reaction by which sulphur and phosphorus in the metal are absorbed in the slag. About 7.5 pounds of spar are consumed in this country on the average in the manufacture of one long ton of open hearth steel. For steel manufacture the spar is used in the form of "gravel," standard grade containing 85 per cent and over in calcium fluoride and not more than 5 per cent silica.

From 7 to 10 per cent of the total American consumption of fluorspar is used in the manufacture of ceramic products such as enameled and sanitary ware and opalescent glass. For this purpose a high grade ground fluorspar is used having an analysis of 95-98 per cent calcium fluoride and 1 to 2½ per cent silica, ground to about 100 mesh but occasionally specifications require 200 mesh. For this purpose the ground spar must be pure white. It is shipped in box cars in bulk, or packed in bags or barrels as desired by the purchaser.

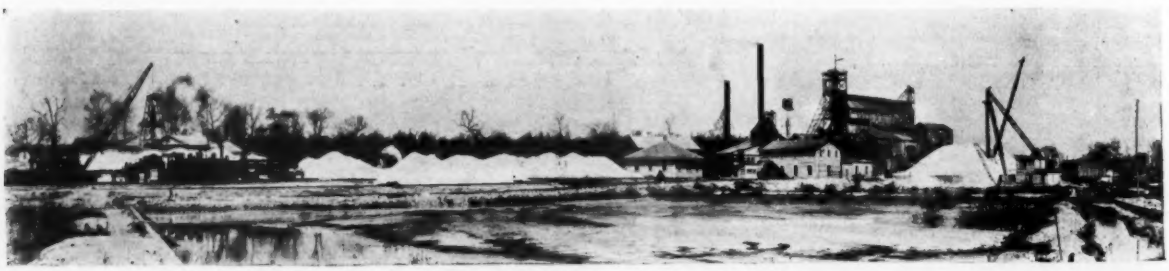


JIG ROOM—ROSICLARE MILL

About 5 per cent is used in foundry cupola practice as a slag thinner, mainly in lump form but not as commonly as in the open hearth steel furnaces. Trade specifications call for lumps varying in size from "nut" up to 12 inches with standard grade carrying 85 per cent and over in calcium fluoride and not to exceed 5 per cent silica.

The highest grade of fluorspar is used in manufacturing hydrofluoric acid. Here the trade calls for material analyzing 98 per

* Oglebay, Norton and Company, Cleveland, O., operating and sales agent for Rosiclare Lead & Fluorspar Mining Co.



PLANT OF THE ROSICLARE LEAD AND FLUORSPAR MINING COMPANY, ROSICLARE, ILLINOIS

cent and over in calcium fluoride and maximum 1 per cent silica. Other uses for fluorspar are in the manufacture of aluminum and sodium fluoride for wood preservatives, the refining of lead, antimony and copper.

Crude fluorspar as it comes from the mines is mixed with mud, calcite and fragments of wall rock consisting of sandstone, shale and limestone. It is, therefore necessary to crush and concentrate this material to prepare a marketable product but prior to crushing, the high grade lump material is separated by passing the ore over a picking belt. The ore which is not separated as lump is crushed, sized and concentrated by means of jigs and tables in the ordinary type of gravity concentrating mill. The average recovery of marketable product from crude ore is about 50 per cent. Most of the ore is mined underground although there are some less important surface deposits. The deepest mining operations are at a depth of 720 feet. In the deeper mines large amounts of water are encountered which necessitate the installation of large pumping units and extensive timbering. As to the origin of the deposits, consensus of opinion among geologists and students of the field is that the solutions or magmas from which fluorspar and associated minerals were precipitated, were uprising. These solutions are commonly thought to have been hot uprising concentrated liquid emanations from basic magma. Associated with fluorspar at times are barite, sphalerite and galena. Separation of these minerals is effected by jigs and tables; to a less extent flotation has been used to recover the sphalerite. These concentrates are sold to the smelters as a by-product.

Rosiclare is the center of the industry in Illinois, and Marion in Kentucky. No foreigners or negroes are employed in the district and all operations are conducted on an open shop basis. The labor is typically native born American stock. The industry is served by the Illinois Central Railroad. The summers are long and pleasant, the winters mild, snow being very unusual.

The Glass World and What It Is Doing

News of the Industry

Promising Prospects for Glass Container Meeting

Governor Moore of the State of New Jersey will be the principal speaker at the convention of the Glass Container Association at the Marlborough-Blenheim Hotel, Atlantic City, N. J., May 5, 6 and 7. The gratifying number of responses received from the notice of the meeting sent to members indicates that this will be one of the best attended meetings in the history of the association. Many ladies will be present and everything possible will be done to make them have a good time.

It is expected that the golf tournament will be held Saturday morning at Atlantic City Country Club (Northfield).

The meetings will open on Thursday, May 5, and will offer an opportunity for the discussion of matters of great importance to the industry.

On Thursday morning at 9:30 (daylight saving time) the crowd will get together in the foyer to greet old friends and meet new ones. In the afternoon after registration the members will hear and discuss reports from the statistical committee and statistical department, research and traffic departments.

On Friday morning after routine business is disposed of and the treasurer's report presented, President Frank Ferguson will make an address of welcome. Judge Jennings' report as business manager will be heard. After Governor Moore's address the appointment of the nominating commitee and election of directors will take place.

On Friday afternoon an address on "Developing Markets for Fruits and Vegetables by Advertising and Publicity" will be given by James Moore, president New York Canners, Inc. I. R. Stewart, chairman, Anchor Cap & Closure Corporation will report for the publicity committee an outline of the advertising, publicity and merchandising work of the past year together with plans and recommendations for the future. Three-minute talks will be given by leading executives of the glass container and cap industries.

The dinner will be held at 7 p. m. (daylight saving time) at the Hotel Traymore.

The Purposes and Activities of the Association

A Statement of Purposes and Activities of the Glass Container Association, prepared for those who desire to acquire a better understanding of the organization and its aims and objects has been issued. The statement tells how the Association is organized and operated and describes the various departments and their activities, including the research, traffic, statistical departments, the business and administration office, the Association magazine, and gives interesting facts concerning the work being done on standardization of finishes and in connection with the tariff. Attention is called to the legislative activities, governmental contacts, publicity and advertising and the group activities of members, where the questions of general industrial import are dominant. The manufacturers of caps are finding group meetings of particular value to them. The manufacturers of milk bottles are solving some very important and far-reaching problems by this method of organization and it is predicted that the organization of other groups within the industry will become more and more prominent.

Spring Meeting of American Refractories Institute

The annual spring meeting of the American Refractories Institute will be held on Wednesday, May 18, at the Hotel Traymore, Atlantic City, and for Thursday, May 19, a golf tournament has been planned. On Wednesday a buffet luncheon will be served in connection with the technical meeting and in the evening a dinner will be given to which special speakers have been invited. Reservations for the dinner should be made in advance through the office of the secretary, Dorothy A. Texter, 2202 Oliver Building, Pittsburgh, Pa. The following papers will be presented:

Research in the Refractories Industry, by M. C. Booze, vice-president, Chas. Taylor Sons Company, Cincinnati, O.

Properties of Clay Refractories Resulting from the Control of Grain Size of the Flint Clay, Refractories Fellowship, Mellon Institute, Pittsburgh, Pa.

Some Characteristics of Fire Clays and Brick Made from Them, by R. F. Geller, Bureau of Standards, Washington, D. C.

The Effect of the Use of Purite Upon Refractories, by G. S. Evans, The Mathieson Alkali Works, Chicago, Ill.

For the last half year the Refractories Fellowship has been conducting investigations on control of grain size of clay refractories and it is believed that this study, although incomplete, will probably lead to the greatest development that could be expected in clay refractories.

Among numerous subjects relating to refractories on which discussion is invited are the following: "What does the industry need in the way of technical development?" "Is the ceramic engineer as at present being turned out by the Department of Ceramic Engineering satisfactorily serving the refractories industry? In what respect is his training lacking?" etc.

The questionnaire phase of the program is new and it is hoped that those having something to offer on any of the questions will come to the meeting prepared to give a short discussion. Arrangements have been made to have one or two individuals, chosen particularly for their authority on their particular question, to start the discussion, after which they will be open for general discussion.

Control of Thatcher Manufacturing Company Sold

Francis E. Baldwin, president of the Thatcher Manufacturing Company, Elmira, N. Y., has sold his controlling interest to a syndicate of bankers. Mr. Baldwin has been interested in the company since 1900 when the factory was located at Potsdam, N. Y. In a story of his life in *The Oneonta Star* it states that the business was not at first a financial success and in 1902 the directors and stockholders insisted that Mr. Baldwin, whose training had been in law, take charge of the business. Within six months, Mr. Baldwin was able to show a profit.

He was one of the earliest manufacturers to adopt the Owens automatic bottle machine and in 1905 obtained the exclusive rights to use it in the making of milk bottles. After the Hartford-Empire machine was developed rights to its use were controlled by four milk bottle manufacturers, but it was not an entire success. Mr. Baldwin had faith in the possibilities of the machine and purchased the four companies involving an investment, it is said, of $3,000,000. With the financial backing of the late E. D. Libbey of Toledo, which was given in spite of the fact that Mr. Libbey was interested in the Owens machine, Mr. Baldwin was able to develop the project and the company now does a business of over $5,000,000 annually and operates plants at Elmira, Dunkirk and Lockport, N. Y.; Streator, Ill.; Cedar Grove and Parkersburg, W. Va.

It is reported that H. C. Mandeville has become chairman of the board, and R. W. Niver president. It is said that no other changes will be made in the personnel of the company.

Annual Meeting of German Glass Technologists

The seventh meeting of the German Society of Glass Technology will be held on May 19 and 20 in the city of Weimar, the capital of Thuringia, one of the world's great glass centers, famous for its optical glass industry, its chemical glassware, thermometers, scientific glass instruments, and the seat of the industry producing Christmas-tree ornaments, ornamental glass articles, and artificial eyes.

The following papers will be presented:

1. The Development of the Thermometer Industry in Thuringia, by Dr. H. Fisher, Ilmenau.
2. Gases in Glass, by Dr. H. Salmang, Aachen.
3. The Sillimanite-Mullite Problem, by Dr. W. Eitel, Berlin.
4. Contribution to the Question of the Nature of the Glassy State, by Dr. E. Berger, Jena.

4a. Studies of the Course of Expansion during the Change from the Amorphous Solid Condition to the Viscous Condition of Glass, by Dr. A. Klemm, Jena.

5. Physical and Chemical Properties of the System: Sodium-Potassium-Calcium-Aluminum-Silicate, by Dr. E. Berger, Jena.
6. The Plate Glass Casting Process of Bicheroux, by Dr. A. Wendler, Berlin.
7. The Automatic Regulation of the Gas Pressure in Glass Works, by Dr. W. Friedrichs, Stützerbach.

After the papers the following motion pictures will be presented:

1. Grinding materials for Glass Working.
2. The Manufacture of the Zeiss-Punktal Glass.

There will be exhibits of glass working machinery and utensils, and an exhibition of Thuringia Art Glass.

Russian Glass Men Investigate American Methods

Three representatives of the Ukrfarfortrust (Ukraine porcelain and glass trust) which controls sixteen factories in Ukraine, four of which are glass and the rest china producers, have completed a trip through china and glass factories of the east and middle west, made for the purpose of learning the most modern methods of production and observing American machinery in operation. The party consists of S. A. Ratajchak, president of the trust, S. S. Kariagin, engineer, and J. B. Zeldes, technical director. They expressed themselves as much pleased with the reception accorded them and the valuable information on American methods given to them. It is the intention of their organization to build a new glass plant and a new china factory at Kiev. In the glass factory pressed and blown tumblers and other tableware will be made, most of the equipment to be of American manufacture including automatic pressing and blowing machines, batch mixers, conveyors and other modern labor saving devices. It is possible also that American gas producers will be installed. The china factory will also be equipped to a large extent with American machinery and modern tunnel kilns, for producing 1,000 tons of common tableware a month. After an early return of the delegates to their home country, orders covering the American equipment for these two factories will be placed, based largely on the results of their investigations during this trip.

According to members of the delegation, as a result of the World War and the civil conflicts, the output of the glass and china industry of the Soviet Union had fallen in 1920 to about 4 per cent of pre-war. Over one-third of the plants were in territory lost to Russia at the close of the war. In 1925 the output increased 45 per cent over the previous years and last year 60 per cent.

Clay and Flint Industries to Standardize Discounts

At a recent meeting in New York City of twenty-five representatives of firms engaged in the production and importation of clay, flint and feldspar, steps were taken towards standardizing terms and discounts in these industries.

The purpose of the group will be to reduce credit losses of the members by securing close co-operation in credit matters. Among those reported at the meeting were: F. G. Lord of Pennsylvania Glass Sand Company and Pennsylvania Pulverizing Company, Lewiston, Pa.; George I. Hamilton of Innis, Speiden & Company, New York; Miss M. A. Murray, V. V. Kelsey and H. P. Margerum, of Golding Sons Company, Inc., Erwin Feldspar Company and Clinchfield Products Corporation, Trenton, N. J.; Henry N. Hanna, Seaboard Feldspar Company, Baltimore, and Oxford Mining & Milling Company, Portland, Me.; Arthur Kuppinger, Seaboard Fuel Corporation, Philadelphia; E. A. Kirkland, R. T. Vanderbilt Company, New York; T. J. Cummings, J. W. Cummings Feldspar Company, Bath, Me.; H. M. Gillespie, Hammill & Gillespie, Inc., New York; L. E. Riddle, Jr., Edgar Plastic Kaolin Company, Trenton, N. J.; C. M. Franzheim, Maine Feldspar Company, Brunswich, Me., and National Silica Works, Berkeley Springs, W. Va.; and George C. Crossley, United Clay Mines Corporation, Trenton N. J.

Government Acts to Break Up Potash Trust

In an attempt to break up the alleged German-French potash trust, complaints have been filed in the United States District Court at New York against sixteen defendants, charged with violating the Sherman Law, an anti-trust provision of the Wilson Tariff Act. Among the defendants are the Deutsches Kalisyndikat and Gesellschaft, a German syndicate controlling potash in the German Republic; the Societe Commerciale des Potasses d'Alsace, a French syndicate; the Potash Importing Corporation of America, with offices at 10 Bridge street, New York; Dr. Maximilien Kempner, Dr. Oskar Eckstein, A. Diehn, Robert Kunze and Dr. Ernest Frohnknecht, German citizens who are now living at the Hotel Plaza; also E. K. Howe and H. A. Forbes, officers of the Potash Importing Corporation of America.

A conspiracy to control the monopoly of the potash industry of the United States is charged by the government, which claims that the sale of 90 per cent of the 1,000,000 tons of potash consumed in this country annually is divided between the French and German companies, who control the only large source of supply of this material. It is charged that the business has been put into the hands of a single selling agency with which the companies involved agree upon the price purchasers must pay.

Importers and Distributors to Attend Tariff Hearing

In a notice to members of the National Glass Distributors Association, North Storms, secretary, urges them to attend the plate glass hearing before the United States Tariff Commission which opens on May 9, at Washington. A meeting of the Eastern and Western Divisions of the Association to take the place of the regular divisional meetings, will be held in Washington on May 11, mainly for discussion of the tariff hearing, although other matters will also be taken up. At the time of going to press with this issue it was announced that the meeting would be held in the assembly rooms of the Chamber of Commerce.

At a meeting of the Association of Imported Plate Glass Consumers which was held on April 25, the executive committee including: L. Solomon, of L. Solomon & Son, New York, as chairman; J. Gibian, of Schrenk & Company, Hoboken, N. J.; and Frank Bostock, Bostock-Rhoades & Company, New York, were reappointed and will represent the association at the public hearing on plate glass in Washington.

Flat Glass Workers Urge Adequate Tariff Protection

The Window Glass Cutters' and Flatteners' Protective Association of America and the Window Glass Cutters' League of America have organized a committee, with B. W. Miller as chairman and O. B. Cline, vice-chairman, and with the secretaries of the two organizations, Harry D. Nixon of the former, and J. W. Rutter of the latter, as members. The object of the committee is to aid in obtaining greater tariff protection, and a letter giving data on the situation and urging action in that direction has been sent to the chairman of the Tariff Commission and to con-

gressmen in various districts whose constituents include glass factories

The domestic manufacturers of window glass have also presented a paper to the Tariff Commission, setting forth existing conditions and asking higher tariff rates on window glass. The Commission was requested to investigate the difference in the cost of production of window glass here and abroad.

Bursting Tanks Cause Damage

Several serious losses from bursting glass tanks occurred during the past month. On April 8 at the Whittemore Glass Company, Dunbar, W. Va., a tank collapsed and a fire followed, causing a reported damage of $25,000. The glass was being melted preparatory to resuming manufacturing operations on April 12.

A tank containing about 200 tons of molten glass bursted on April 4 at the Graham Glass Company, Evansville, Ind., causing fire and considerable loss.

At the Atlantic Bottle Company's plant at Brackenridge, Pa., the manager, Harry Ganter and Albert Speicher were injured when a tank which was being repaired let go while they were on a platform beside it. Mr. Ganter was reported to have received burns on the arms and chest and was taken to his home, although not seriously injured. Albert Speicher suffered a broken ankle when jumping from the platform to the floor.

Bohemian Workers Resent Use of American Machinery

According to a special cable from Prague, Czechoslovakia, to the *New York Times*, the introduction into North Bohemia of American standardization methods, by which certain grades of cut glass no longer are made, the Iser Mountains region has been greatly affected and many glass works have been put out of business.

As a result a demonstration of 1,000 glass workers occurred in Tannwald and Morchenstern, and several factories were wrecked and the cut glass machinery demolished. The demonstration lasted three hours, but only factories containing cut glass machinery were sabotaged.

Two of the leading deputies representing North Bohemia glass centres now have appealed to the Czechoslovak government for protection for the factories and property.

A considerable proportion of the output of these North Bohemian glass factories is shipped to America and England.

Record Construction Contracts in March

Construction contracts to the amount of $620,738,200, were awarded last month in the 37 States east of the Rocky Mountains, according to F. W. Dodge Corporation. This tops the previous high record of August 1925 by 9 million dollars. The increase over March 1926 was nearly 4 per cent and the increase over February of this year was 57 per cent.

The March record brought the contract total for the first quarter of this year up to $1,398,776,100, which is only about 4½ per cent below the figure for the corresponding period of last year. At the end of January this year was 16 per cent behind last year; at the end of February, 10 per cent behind; at the end of March, only 4½ per cent behind. This shows that there was in March a quite considerable recovery from the low contract volumes of the preceding two months.

Establish Erwin Feldspar Fellowship

Early in May, the Erwin Feldspar Company, Inc., state, they will established a fellowship at the University of Illinois for the purpose of making a detailed study of feldspar, with the idea of furnishing useful information which will enable the pottery, tile, sanitary and glass manufacturers to use this mineral to the best advantage.

This work will include thermal expansion, thermal elasticity, specific gravity determinations, petrographic determinations, chemical analyses, vitrification range and the determination of other properties.

Selection of a chemist to occupy the post has not yet been made.

Plate Glass Production

From figures compiled and issued by P. A. Hughes, secretary of the Plate Glass Manufacturers of America, the production of polished plate glass for the month of March, 1927, was 11,641,036 sq. ft., making a total for the first three months of 1927 of 29,914,633 sq. ft., which is 2,974,734 sq. ft. less than that produced in the same period in 1926 when the production was 32,889,367 sq. ft. It is interesting to note that the figures for production in the first quarter of this year amount to only about 11 per cent less than for the same period of the year 1926.

Revokes Order Prohibiting Dumping of Glass

Further investigation by the Department of the Treasury into the matter of dumping colored antique window glass into this country against which an order was issued on September 9, 1926 has convinced the Department that the decision was based on incorrect information and that there is no reason to believe that the imported merchandise in question is being sold at less than its fair value. The finding as made on September 9, 1926 is therefore revoked.

Sells British Patents on Miller Feeders

Wm. J. Miller, Inc., Swissvale, Pa., are reported to have disposed of all their patent rights covering the British Isles on the Miller glass feeder, to the British-Hartford-Fairmont, Syndicate, Ltd. The patent rights on the feeder in the United States are controlled by the Hartford-Empire interests.

A meeting of the Western Pennsylvania Safety Council and associated organizations was held on April 14, presided over by C. E. Ralston, safety director of the Pittsburgh Plate Glass Company. Papers on pertinent subjects were presented by many representatives of prominent manufacturing organizations. Among the papers was "Infection from Lubricants," by George W. Pressell, chief research engineer, E. F. Houghton & Company, Philadelphia, Pa.

The National Foreign Trade Convention, which will be attended by representatives of practically all important industries, will meet in Detroit on May 25, 26 and 27. Secretary Hoover will speak at the convention under the auspices of the American Manufacturers Export Association. Other prominent men will also address the convention.

The Stained Glass Association of America will hold its twenty-seventh annual convention in St. Louis, Mo., June 27, 28, and 29. The members are invited to take along their wives and daughters for whom special entertainment will be provided. The association is seriously considering the making of another trip to Europe.

The National Gift and Art Association, with headquarters in the Drexel Building, Philadelphia, Pa., will hold its fall exhibition August 22 to 27, at the Hotel Adelphia, Philadelphia. Manufacturers desiring to exhibit can obtain particulars from the association's office at the above address.

The Government of Czechoslovakia presented to the Cathedral of St. John the Divine at New York on March 13, a great chandelier made of thousands of pieces of Bohemian glass by Czechoslovafian artists. It is said that forty workmen spent a year preparing and putting in place the gleaming bits of crystal.

According to a report by O. L. Bunn, secretary and manager of the Birmingham (Ala.) Chamber of Commerce, a bottle manufacturing plant has been erected and equipped at Tarrant City, near Birmingham, and operations will begin soon.

An exhibition of chemical apparatus, the fifth to be held in connection with a conference of the Association of German Chemists, an organization which includes about 10,000 German chemists, will take place June 7 to 19, at Essen, Germany.

Trade Activities

The Blue Ridge Glass Corporation, Kingsport, Tenn., has increased its capital from 30,000 to 35,000 shares of no par value.

An issue of $1,000,000 in first mortgage closed 6 per cent bonds has been announced by the **Root Glass Company,** Terre Haute, Ind. Security for the bonds consists of a mortgage covering real estate in Indiana.

The Ohio Valley Convex Glass Company has been organized at New Martinsville, W. Va., by Jules Charles, J. H. Riggenbach, Robert U. Andre, H. M. Phillips and H. L. Green, and is now producing bent and convex glass.

The Brockway Sales Company, Brockway, Pa., has applied for a Pennsylvania charter to promote the buying, selling, manufacturing of and dealing in glass and glassware and other products.

The Brown Instrument Company, manufacturers of pyrometers, flow meters, etc., Philadelphia, Pa., announce that owing to increased business in Cincinnati and vicinity they have opened a branch at 718 First National Bank Building, that city, with J. R. Green as district manager.

The Wightman Bottle and Glass Manufacturing Company, Parkers Land, Pa., are erecting a concrete and steel warehouse 100 by 300 feet which, when completed, will serve as the shipping headquarters for several factories under the same management.

The National Plate Glass Company's new plant at Ottawa, Ill., was closed on April 15 for extensive repairs and alterations. According to John M. Berg, general manager, the old plant employing about 550 men was not shut down. It is expected that operations in the newer plant will be resumed in May.

Potter Palmer, of Chicago, has been elected a director of the Libbey-Owens Securities Corporation, according to a recent announcement by the Graham Brothers Corporation. Mr. Palmer is also a director of the Libbey-Owens Sheet Glass Company, Toledo, O., and of the United States Sheet and Window Glass Company, of Shreveport, La., a subsidiary.

The American Window Glass Company is reported to have let a contract to the Ballinger & Andrews Construction Company of Pittsburgh for remodeling their main building at their Bellevernon, Pa., plant which has been idle for a long time. It is said that the new plant will be equipped to make sheet glass by a process similar to that developed by Fourcault.

The Pine Glass Corporation, recently organized at Okmulgee, Okla., according to H. G. Pine, is planning to erect and equip a plant estimated to cost from $250,000 to $300,000, which will have a daily production of 500 gross of fruit jars, etc. The officers of the new company are: W. B. Pine, president; H. G. Pine, vice-president; R. D. Pine, second vice-president; O. A. Bingman, treasurer, and A. J. Gill, secretary.

The Victory Window Glass Company, affiliated with the Baker Brothers Glass Company, has announced that it has renewed its lease on the plant of the Sunflower Glass Company, Sapulpa, Okla., and will resume operations about May 15. Four machines have been installed to make flat glass under the Baker Brothers patents. The glass is sold under the trade name of Baker Brothers Glass Company.

The Zihlman Glass Company, which was recently organized at Cumberland, Md., by James J. Kirk, president, and A. E. Zihlman, secretary-treasurer, has let a contract for the erection of concrete and steel building, 160 by 60 feet, to cost approximately $35,000 and will install glass making equipment to cost about $15,000. The company will manufacture goblets, tumblers, vases, etc.

The Braddock Glass Works, Cumberland, Md., has been organized by Carl L. Borchert, president, and Louis H. Borchert, secretary and treasurer. The new concern has secured a large stone and concrete warehouse and installed machinery and equipment for the manufacture of a fancy line of thin blown stemware and tumblers, both crystal and colored. Manufacturing operations began on May 1.

The Standard Sheet Glass Company, recently organized, has taken over the plant of the Eldred Window Glass Company at Punxsutawney, Pa. The officers of the new company are D. L. Dennis, president; R. W. Hilton, vice-president; T. W. Kreamer, secretary-treasurer; E. S. Swartz and Raymond Dereume, directors, and J. L. Fisher, solicitor. The plant is to be equipped with glass blowing machines invented and developed by Mr. Hilton.

At the annual meeting of the **Standard Plate Glass Company,** Pittsburgh, Pa., A. Perry Osborn and W.B. Purvis were elected directors, succeeding Stanhope S. Goddard and Nielsen Edwards, all the other retiring directors being re-elected. At an organization meeting the following officers were elected: Frank E. Troutman, chairman of the board, succeeding Joseph Heidenkamp; R. B. Tucker, president; Joseph D. Watson, vice-president; Joseph Heidenkamp, Jr., secretary, and J. R. Eckler, treasurer.

Work on the **General Flat Glass Company's** plant at Mannington, W. Va., is progressing favorably. The company has fitted up its own machine shops where the glass drawing machines are being completed, also a plant for making the required refractories for this process. All of the machinery will be electrically driven. Natural gas furnished by the Hope Natural Gas Company will be used in the melting tank. It is said that the capacity of the plant will be about 300,000 boxes of flat glass per year.

The Thatcher Glass Company's plant at Dunkirk, N. Y., closed down the first of May for eight weeks for the purpose of making repairs which, according to C. W. Luce, general manager, will be more extensive than usual this year. The furnace and bottle machines will be raised to the floor level and improvements made to the lehrs. While the factory is closed down the force of 115 employees will work on the new furnace. The plant, which turns out approximately 100,000 milk bottles every twenty-four hours, will resume operations late in June or early in July.

The Rolland Sheet Glass Company, Clarksburg, W. Va., recently organized with a capital of $100,000 by Eugene Rolland, Aristide Rolland, Albert Rolland, Charles Rolland and August Malfregeot, and which has taken over the factory of the Lafayette Window Glass Company, will erect a new plant on the same site. The process to be used will be similar to the Fourcault process, and machinery is now on its way to this country from Europe where it was purchased by Eugene Rolland, president of the company. It is expected that the plant will be ready for operation early in the fall.

New Publications

BIBLIOGRAPHY OF LITERATURE ON REFRACTORIES, compiled by members of the Refractories Division, American Ceramic Society, issued February, 1927, 138 pages. Price $2.00. This volume, the third in the series, is general in character, and contains the following chapters: General, Fire Clay, Aluminous, Magnesia, Dolomite, Chrome, Silica, Silicon Carbide, Fused Silica, Graphite, Special Refractories, Special Uses, Cement, Mortars and Bonding Materials. The preparation of this bibliography has been in charge of the members of the staff of the Ceramic Engineering Department of the University of Illinois. The work has been made possible by funds provided chiefly by the Insull interests, and also by the American Ceramic Society. The references number 885 and the index fills 28 pages.

REFRACTORIES UTILITY CHART, issued by the American Refractories Institute. A 8½ by 11 inch card showing the utility of refractories. The factors of service and properties of refractories given are believed to cover the conditions more commonly encountered. On the reverse side of the card are temperature conversion tables by Albert Sauveur and a table of end points of pyrometric cones. Copies of this chart may be obtained by applying to the secretary, Dorothy A. Texter, 2202 Oliver Building, Pittsburgh, Pa.

AMERICAN REFRACTORIES INSTITUTE—Technical Bulletin No. 6, devoted to a discussion of "Nomenclature for Refractories," includes a chart which indicates the numerous properties required of a refractory and shows that they must be inherent in varying degrees depending upon the service condition to which they are to be applied. It is requested that the proposed "Utility Chart" in the Bulletin be studied with the viewpoint of offering suggestions, and it is hoped it will eventually evolve into a practical and useful reference for those interested in refractories.

Industrial Publications

Barnstead Automatic Water Stills. Catalog A., a handbook issued by the Barnstead Still and Sterilizer Company, Boston, Mass., on Barnstead water distilling apparatus for all purposes—industrial, scientific and commercial. Chemically pure distilled water is a necessity in mirror manufacturing plants to clean the glass before the silver is applied. If impure water is used, spotting and discoloration will result. The Barnstead corporation has had many years of experience in the manufacture of distilling equipment which is extensively used in the mirror trade. The new catalog describes their products and uses, which include stills heated by steam, gas, kerosene or electricity. A page is devoted to instructions on how to select the proper still. Copies of the catalog may be obtained upon request.

Centrifugal Air Compressors. General Electric Company, Schenectady, N. Y. A 4-page folder describing part of a complete line of centrifugal air compressors or blowers ranging in volume from 250 to 75,000 cubic feet per minute and 0.75 to 30 pounds pressure. The company has been manufacturing for the past ten years a line of small multi-stage units rated at 250 to 575 cubic feet per minute and 0.75 to 4.0 pounds pressure. Changes have been made in the design of the miniature multi-stage sets and special attention is called to the gear type oil pump geared to the motor shaft and providing forced lubrication for the three bearings.

Sirocco Fans and Blowers. Bulletin 8001. American Blower Company, Detroit, Mich. An 80-page catalog describing and illustrating this line of blowers and containing many pages of data such as dimensions, speed, volume, etc.

Coming Meetings

THE GLASS CONTAINER ASSOCIATION will hold its annual meeting at the Hotel Marlborough-Blenheim, Atlantic City, on May 5 and 6.

THE NATIONAL GLASS DISTRIBUTORS' ASSOCIATION will hold a meeting at Washington on May 11, which will take the place of the regular May meetings of the Eastern and Western Divisions.

THE AMERICAN REFRACTORIES INSTITUTE'S spring meeting will be held this year on May 18 and 19 at the Hotel Traymore, Atlantic City, N. J.

THE SOCIETY OF INDUSTRIAL ENGINEERS' 14th annual convention will be held on May 25, 26 and 27 at the Hotel Stevens, Chicago. "The Principles of Effective Management and their Relation to Industrial Engineering" will be the main theme.

THE NATIONAL FOREIGN TRADE CONVENTION will meet in Detroit, Mich., on May 25, 26 and 27.

THE STAINED GLASS ASSOCIATION OF AMERICA will hold its twenty-seventh annual meeting in St. Louis, Mo., on June 27, 28 and 29.

THE NATIONAL GIFT AND ART ASSOCIATION will hold its fall exhibition at the Hotel Adelphia, Philadelphia, Pa., on August 22 to 27.

THE AMERICAN CERAMIC SOCIETY'S next annual meeting will be held at the Ambassador Hotel, Atlantic City, N. J., February 5-11, 1928.

Inquiries Received

For Further Information Address THE GLASS INDUSTRY

369. We would like to be put in touch with some manufacturer, preferably nearby (New York City) who specializes in hand-blown ware. We use from 75 to 100 gross of 14-ounce double-screw neck globes on our soap dispensers. (Apr. 1.)

370. We would like to know if you have any available information as to automatic glass cleaning equipment for cleaning glass circles and ovals approximately 3 to 3½ inches in diameter. (Apr. 14.)

371. Will you kindly give us the names of manufacturers of all sizes and styles of glass crystals, such as are used in chandeliers, etc.? Also names of importers? (Apr. 9.)

372. Can you advise us where we can get suitable apparatus for use in testing the heat expansion of glass? We want an instrument of this kind, but have no means of setting it up and will have to have the entire outfit made outside. (Mar. 31.)

What the World Wants

Specific Inquiries for American Goods Received in the Department of Commerce, Washington, D. C.

Sweden: 24379, pressed-glass articles.
Chile: 24713, table glassware.
South Africa: 24814, fruit jars.
Japan: 24961, machines for inside frosting of incandescent bulbs.
Paraguay: 25200, bottle-making machinery, window, plate and common glass.
Germany: 25144, glassware.
India: 25231, glassware.

Glass Stock Quotations

PITTSBURGH STOCK EXCHANGE, APRIL 22, 1927
Reported by Moore, Leonard & Lynch, Union Trust Bldg., Pittsburgh, Pa.

	Bid	Asked	Last
American Window Glass Machine, Com.	...	...	40
American Window Glass Machine, pfd..	...	...	72
American Window Glass, pfd.....	103	105	...
United States Glass.....	...	13	15½
Pittsburgh Plate Glass, com.	...	...	242
Standard Plate Glass, com.....	...	...	3¼
Standard Plate Glass:			
Preferred cumulative	10	...	13½
Prior preferred	32	...	35⅛

TOLEDO STOCK EXCHANGE, APRIL 25, 1927

	BID	ASKED	LAST
Owens Bottle Machine, com.....	117	117½	117
Libbey-Owens Sheet Glass, com.....	128	130	128½
Libbey-Owens Sheet Glass, pfd.....	115	....	115

WHEELING STOCK EXCHANGE, APRIL 21, 1927

	BID	ASKED	LAST
Hazel-Atlas	....	....	50½
Imperial	....	....	72
Fostoria	....	....	150
Central	....	....	75

READERS WANTS AND OFFERS

WANTED—Young man with engineering or operating experience in glass manufacturing plants, to sell, install and service electric pyrometers, recording instruments and automatic temperature control equipment for use in the glass industry. Candidates must be free for quick transfers and unlimited travelling throughout the United States. Highest character references required. Young single man preferred. Write stating age, education, experience and salary desired. Address Salesman, care THE GLASS INDUSTRY, 50 Church Street, New York.

WANTED: Capable Machinist, who is familiar with Hartford-Empire feeders, Lynch and Miller machines. The man wanted must be able to keep above machines in first class operating condition and keep up production. Write, giving experience and kind of ware most familiar with. A desirable connection for the right man with well established company. Address, Machinist, care THE GLASS INDUSTRY, 50 Church Street, New York.

WANTED—Machine Operators—A few experienced operators for Lynch and Miller machines, in a Russian factory. Must be competent to overhaul, maintain and keep machines in working order to produce good ware. Preference given to those speaking Russian or German. State experience and conditions and submit references. Apply: AMTORG TRADING CORPORATION, 165 Broadway, New York.

Current Prices of Glass-Making Materials

April 22, 1927

Quotations furnished by various producers, manufacturers and dealers.

		Carlots	Less Carlots
Acid			
Citric (dom.)	lb.	.43½	.43½
Hydrochloric (HCl) 20° tanks, per 100 lb.		.95-1.05	..
Hydrofluoric (HF) 60% (lead carboy)	lb.	..	.13½
52% and 48%	lb.	.10	.10-.11½
Nitric (HNO_3) 38° carboy ext. Per 100 lb.		5.50	5.75
Sulphuric (H_2SO_4) 66° tank cars	ton	15.00-16.00	..
Tartaric	lb.	.34-.35	.34-.35¾
Alcohol, denatured	gal.	..	.40½
Aluminum hydrate ($Al(OH)_3$)	lb.	.05	.05½
Aluminum oxide (Al_2O_3)	lb.	..	.07
Ammonium bifluoride (NH_4FHF)	lb.	..	.21-.22
Ammonia water (NH_4OH) 26° drums	lb.	..	.03
Antimony, metallic (Sb)	lb.	..	.14¾
Antimony oxide (Sb_2O_3)	lb.	..	.16½
Antimony sulphide (Sb_2S_3)	lb.	.15	.16½
Arsenic trioxide (As_2O_3) (dense white), 99%	lb.	.03¾	.04
Barium carbonate ($BaCO_3$)			
Precipitated	ton	53.00	58.00
Natural, powdered, imported	ton	48.00	50.00
Barium hydrate ($Ba(OH)_2$)	lb.	..	..
Barium nitrate ($Ba(NO_3)_2$)	lb.	.08¼	.08½
Barium selenite ($BaSeO_3$)	lb.	..	..
Bone ash	lb.	.05	.05½
Borax ($Na_2B_4O_7 10H_2O$)	lb.	.04	.04¼-.04¾
Boric acid (H_3BO_3)	lb.	.08	.08½-.09¼
Refined	lb.	.08-.09½	.08½-.10¾
Cadmium sulphide (CdS)—			
Red	lb.	..	1.20
Orange	lb.	..	1.10-1.25
Yellow	lb.	..	1.20-1.40
Chromium oxide (Cr_2O_3)	lb.	.27	.28
Cobalt oxide (Co_2O_3)			
In bbls.	lb.	..	2.10
In 10 lb. tins	lb.	..	2.20
Copper oxide			
Red (Cu_2O)	lb.	..	.30
Black (CuO)	lb.	..	.25-.30
Black prepared	lb.	..	.30
Cryolite (Na_3AlF_6) Natural Greenland			
Kryolith)	lb.	..	.09½-.09½
Artificial or Chemical	lb.	..	.09½
Epsom salts ($MgSO_4$) (imported) Per 100 lb.		1.20	1.30
Feldspar—			
100 mesh	ton	11.00-20.00	16.00-22.00
80 mesh	ton	13.50	..
40 mesh	ton	12.50	13.50
Fluorspar (CaF_2) domestic, ground, 95-98% (max SiO_2 2½%)			
Bulk, carloads, f.o.b. mines	ton	32.50	..
In bags or barrels	ton	36.50	41.50
Formaldehyde	lb.	.11¼	.11¾
Graphite (C)	lb.	..	.04-.07
Iron oxide—			
Red (Fe_2O_3)	lb.	..	.02-.03
Black (FeO)	lb.	..	..
Kaolin (f.o.b. mine)	ton	10.00	..
English, lump, f.o.b. New York	ton	13.00-23.00	..
Kryolith (see Cryolite)			
Lead chromate ($PbCrO_4$)	lb.	..	..
Lead oxide (Pb_3O_4) (red lead)	lb.	.10¼	.10¼-.10½
Litharge (PbO)	lb.	.09¾	.09¾-.10
Lime—			
Hydrated ($Ca(OH)_2$) (in paper sacks)	ton	12.50	..
Burnt (CaO) ground, in bulk	ton	9.00	..
Burnt, ground, in paper sacks	ton	11.00	..
Burnt, ground, in 280 lb. bbls.	Per bbl.	2.15	2.30
Limestone ($CaCO_3$)		2.00	..
Magnesia (MgO)—			
Calcined, heavy (in bbls.)	lb.	.04	.04½
light (in bbls.)	lb.	.22	.24
extra light (in bbls.)	lb.	..	.37
Magnesium carbonate ($MgCO_3$)	lb.	.06	.08½
Manganese 85% (MnO_2)	lb.	.04½	.05
Nickel oxide (Ni_2O_3), black—for nickel content	lb.	..	.35
Nickel monoxide (NiO), green—for nickel content	lb.	..	.35
Plaster of Paris, bags	ton	..	19.00
Potassium bichromate ($K_2Cr_2O_7$)—			
Crystals	lb.	.08¼	.08⅝
Ground	lb.	.11	.12
Potassium carbonate—			
Calcined (K_2CO_3) 96-98%	lb.	.06¾	.07
Hydrated 80-85%	lb.	.06	.06¼
Potassium chromate (K_2CrO_4)	lb.	..	.27
Potassium hydrate (KOH) (caustic potash)	lb.	.07½	.08
Potassium nitrate (KNO_3) (gran.)	lb.	.05⅞-.06	.06⅛-.06¼
Potassium permanganate ($KMnO_4$)	lb.	.13½	.14
Powdered blue	lb.	..	.24-.26
Rochelle salts, bbls.	lb.	..	.21
Rouge	lb.	..	..
Rutile (TiO_2) powdered, 95%	lb.	.15-.20	.20-.25
Salt cake, glassmakers (Na_2SO_4)	ton	22.00	..
Selenium (Se)	lb.	..	2.10-2.15
Silver nitrate ($AgNO_3$)	oz.	..	.41
Soda ash (Na_2CO_3) dense, 58%—			
Bulk, on contract	Flat per 100 lb.	1.22½-1.27½	..
In barrels	Per 100 lb.	1.55-1.57½	2.40
In bags	Per 100 lb.	1.37½	..
Spot orders	.05 per 100 lbs. higher		
Sodium bichromate ($Na_2Cr_2O_7$)	lb.	.06¼	.06¾
Sodium hydrate (NaOH) (caustic soda)	Per 100 lb.	..	..
Sodium nitrate ($NaNO_3$)—			
Refined (gran.) in bbls.	lb.	.03⅞	.04⅛
95 per cent	Per 100 lb.	2.60	2.85
Sodium selenite (Na_2SeO_3)	lb.	..	2.35
Sodium fluosilicate (Na_2SiF_6)	lb.	.05	.05½
Sodium uranate (Na_2UO_4) Yellow or Orange	lb.	..	1.25
Sulphur (S)—			
Flowers, in bbls.	Per 100 lb.	3.45	3.80-4.00
Flowers, in bags	Per 100 lb.	3.10	3.45-3.65
Flour, heavy in bbls.	Per 100 lb.	2.85	3.20-3.40
Tin chloride ($SnCl_2$) (crystals)	lb.	..	.47
Tin oxide (SnO_2) in bbls.	lb.	..	.70
Uranium oxide (UO_2) (black, 96% U_3O_8) 100 lb. lots	lb.	..	1.25-2.25
Zinc oxide (ZnO)	lb.	.06⅛	.07

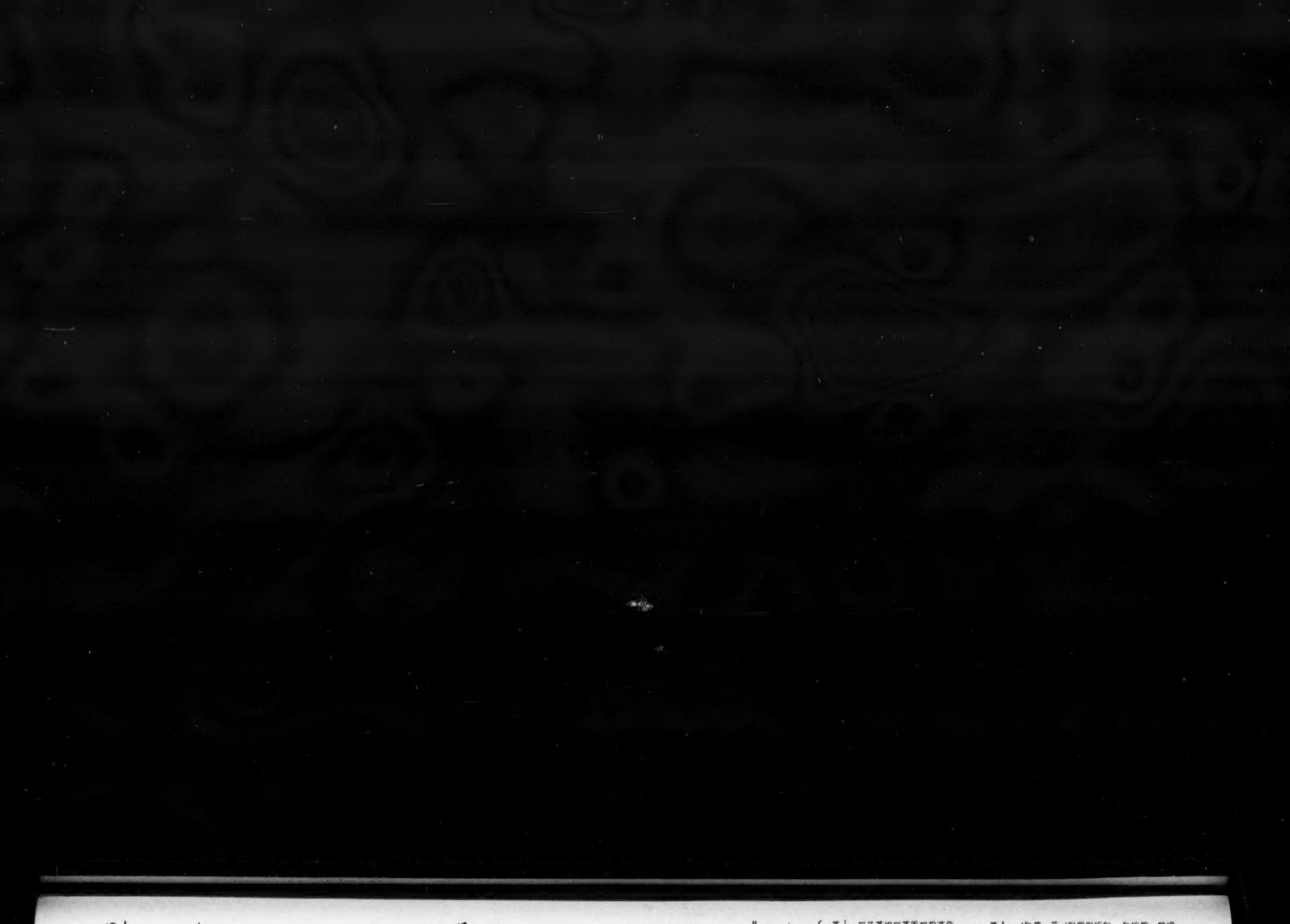
Monthly Summary of United States Foreign Commerce in Glass

EXPORTS

Corrected to March 24, 1927

		February 1925 Quantity	February 1925 Value	February 1926 Quantity	February 1926 Value	Two Months Ending February 1925 Quantity	Two Months Ending February 1925 Value	Two Months Ending February 1926 Quantity	Two Months Ending February 1926 Value
Glass and glass products (total)		.....	$659,951	.....	$619,497	.....	$1,333,332	.....	$1,323,674
Plate and window glass—									
Window glass, common, box 50 sq. ft.		3,785	18,236	646	3,710	8,600	41,380	2,996	19,541
Plate glass, unsilvered, sq. ft.		204,654	31,253	132,544	32,810	324,266	59,220	244,324	63,034
Other window and plate glass	lbs.	185,213	13,990	226,710	25,868	317,465	33,897	638,671	54,864
Glass containers (bottles, vials and jars)		.....	199,425	.....	192,835	.....	413,627	.....	387,305
Table glassware, plain		.....	112,136	.....	97,014	.....	222,939	.....	220,971
Table and other glassware, cut or engraved		.....	11,322	.....	11,813	.....	22,843	.....	20,154
Lamp chimneys and lantern globes	lbs.	214,855	41,364	188,672	34,795	420,383	76,864	393,341	82,998
Globes and shades for lighting fixtures	lbs.	137,555	43,569	124,146	50,456	283,458	91,438	283,242	102,461
Chemical glassware	lbs.	20,595	16,995	7,970	9,967	39,183	34,223	24,619	24,043
Electrical glassware, except for lighting	lbs.	537,704	44,441	257,152	24,012	1,059,793	80,056	428,125	48,224
Other glassware		.....	127,220	.....	136,217	.....	256,845	.....	300,079

IMPORTS

Corrected to March 24, 1927

Glass and glass products		.....	1,367,058	.....	1,264,449	.....	2,761,542	.....	2,649,654
Cylinder, crown and sheet—									
Unpolished	dut. lb.	4,761,765	196,094	.....	.....	10,120,654	422,471	.....	.....
Weighing less than 80 pounds per case	dut. lb.	.....	.....	3,800,638	101,008	.....	.....	7,442,063	199,777
Weighing 80 pounds or over per case	dut. lb.	.....	.....	3,496,155	155,197	.....	.....	6,977,493	368,594
Bent, ground, beveled, colored, painted, etc., and polished	dut.	.....	26,365	.....	29,063	.....	94,148	.....	72,404
Plate glass	dut. sq. ft.	1,765,621	601,290	.....	.....	3,808,860	1,228,217	.....	.....
Polished, unsilvered	dut. sq. ft.	.....	.....	1,030,992	364,998	.....	.....	2,388,052	862,402
Other plate glass	dut. sq. ft.	.....	.....	118,763	16,928	.....	.....	246,198	44,103
Containers—bottles, vials, etc.	dut.	.....	27,855	.....	14,031	.....	46,673	.....	37,602
Table and kitchen utensils	dut.	.....	3,206	.....	7,651	.....	6,885	.....	25,306
Glassware, cut or decorated	dut.	.....	163,933	.....	301,766	.....	337,891	.....	494,392
Blown glassware, n. e. s.—									
Bottles, ornaments, etc.	dut.	.....	76,454	.....	50,320	.....	117,579	.....	114,227
Bulbs for electric lamps	dut.	1,568,385	17,173	1,423,459	12,974	3,242,858	32,950	2,587,336	24,845
Chimneys, globes, shades, etc.	dut. No.	.....	95,234	.....	66,459	.....	173,179	.....	144,343
Articles and utensils for chemical, scientific, and experimental purposes	dut.	.....	35,772	.....	38,068	.....	82,620	.....	73,843
Other glassware	dut.	.....	123,682	.....	105,986	.....	218,979	.....	187,816